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Contents

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Freedom and Responsibility

"The Post Office must be free to make quick decisions; it must be free to use the criteria applied in the world of commerce for gauging efficiency; it must be free to innovate and develop as a business seeking to meet and anticipate its customers' demands."

THESE phrases from the White Paper on *The Status of the Post Office*, the text of which we reproduce on the following pages, express key principles for all Post Office operations but especially for the rapidly developing telecommunication services.

Although we shall be relieved from the obligation to prepare estimates of our annual cash requirements for the traditional processes of Treasury agreement and Parliamentary approval, with the consequent obligation to ensure that money is spent according to the sums voted by Parliament, and to produce an appropriation account to show the final results, we shall still need to budget our expenses for each year. But we shall be able to work more flexibly within this budget, with quicker response to changing need, than heretofore.

But if we are to be masters of our own money, we shall have even greater responsibility for ensuring that we are spending it wisely and well. This should not mean—and indeed, the White Paper implies that it must not mean—that we must in every direction emphasize cost at the expense of function but that, keeping in mind our statutory duty to make the Post Office self-sufficient, we must carry out the function with the utmost care for cost.

The statement affirms that while "commercial aspects must not be allowed to subtract from (our) obligations to the community as a whole, though this may mean giving some service below cost", the Post Office should not be run "primarily as a vast social service without regard to the economic facts of life".

The Status of the Post Office

Plans for Financial Freedom

Introducing in the Commons on March 29 the White Paper (Cmnd 989) on *The Status of the Post Office*, the text of which follows, the Postmaster General said:

"The Government has decided to give practical recognition to the commercial character of the Post Office . . . The commercial character of the Post Office has already been recognized in some degree. These proposals will complete this process by giving the Post Office statutory recognition as a self-contained business. They will encourage the Post Office to approach the problems of organization and management more commercially and to evince an even greater sense of enterprise in providing services which satisfy the needs of the whole community."

I. INTRODUCTION

1. The Post Office is an immense national trading organization. The public spends more than £400 million annually on its postal, telephone and telegraph services. But more than 12 times that amount passes over its counters: indeed, the other facilities it offers—for the remittance of money, for savings, the payment of pensions, and a host of public transactions—involve the handling of more than £5,000 million year by year.

2. At present all Post Office revenues are paid into the Exchequer and monies needed to meet Post Office costs are issued from the Exchequer. It is in direct consequence that the trading activities of the Post Office are still subject to the traditional controls which, in other Departments, aim to regulate the spending of public money raised *by taxation*. Yet, unlike those Departments, the Post Office lives on what its customers spend on its services. That it should do so is the objective of Post Office financial policy.

Proposed Status

3. It is now proposed to give the Post Office greater commercial freedom while remaining under the direct control of the Postmaster General. Its current finances will be severed from the Exchequer and, subject to the Postmaster General's responsibilities as a Member of the Government and to Parliament, he will have greater scope and responsibility for running the Post Office as a self-contained business.

4. The Post Office has many social obligations. But the existence of these obligations does not mean that the Post Office should be run primarily as a vast social service without regard to the economic facts of life. Indeed, in most essential respects it is, and ought to be recognized as—and function as—a commercial organization. If, after allowing for its social responsibilities, it fails to approach the problems of management and organization with a business mind it will quickly become inefficient. The Post Office must be free to make quick decisions; it must be free to use the criteria applied in the world of commerce for gauging efficiency; it must be free to innovate and develop as a business seeking to meet and anticipate its customers' demands.

5. The proposed status should be a renewed spur to enterprise within the Post Office.

II. THE CONSTITUTIONAL POSITION NOW

Changes in 1955

6. The special case of the Post Office as a commercial organization was first recognized by the Bridgeman Report of 1932. The arrangements then introduced were suspended during the war. But in 1955 the Government again agreed that the Post Office should be responsible for balancing its income and expenditure and it was encouraged to conduct its business as a commercial enterprise. These principles, and the arrangements to make them effective, were embodied in the *Report on Post Office Development and Finance* (Cmd. 9576), presented in October 1955. Commercial Accounts were to govern Post Office financial policy. The

Post Office was to contribute a fixed sum of £5 million a year to the Exchequer.

What remained unchanged

7. This change, however, introduced no radical alteration in Parliamentary and accounting procedures to accord with the concept of the Post Office as a trading concern. For all revenue is still paid to the Exchequer and all expenditure has to be voted by Parliament in annual Estimates. And the Treasury retains its power of control over it.

8. Cash accounts still have to be presented, even though they differ widely from the *Commercial Accounts* and they do not reflect the true financial position of the Post Office. These requirements arise because—

(i) since 1787 all Government receipts from taxation or other sources have had to be paid into the Consolidated Fund;

(ii) no Government expenditure for any purpose can be incurred without the specific authority of Parliament.

III. WHAT THE GOVERNMENT NOW INTENDS

Post Office to remain a Government Department

9. In the Government's view, the steps taken in 1955 have proved valuable. They should now be taken to their logical conclusion.

10. It has been suggested more than once that the Post Office—or at least the telephone service—should become a public corporation. But the community expects its mails to be carried by State employees under the direct control of the Government. And there are strong practical reasons for keeping the telecommunications services together with the mails in a single organization. Therefore, both should remain as parts of a Government Department.

11. Moreover, the Bridgeman Report of 1932 argued that "the public have a right to the influence which Parliamentary discussion and control alone can give". The Government agree that there is real advantage in having the Post Office directly represented by a Minister in Parliament. With that reservation—which is important—they have concluded that the commercial character of the Post Office should now be recognized by Parliament in statutory terms.

Staffed by Civil Servants

12. Post Office staff will retain, in full, their status as Civil Servants.

Separation of finances from the Exchequer

13. At the heart of the Government's proposals is the establishment of a statutory Trading Fund for the Post Office. This Fund would be quite separate from the Exchequer. The Treasury would have no responsibility for it. It would be managed by the Postmaster General. All Post Office receipts would be paid into it. All Post Office payments would be met out of it. The present provision for Post Office self-balancing revenue and expenditure would disappear from the Budget.

IV. THE ACCOUNTING CHANGES

Appropriation Accounts

14. As indicated in paragraph 7 the Post Office, in common with other Departments, now has to prepare estimates for its annual cash requirements. These cover salaries and wages, purchase of materials, contract payments, and so on. There is a consequential obligation to ensure that money is spent according to the sums voted by Parliament, after approval of the Estimate. The final results have to be shown in an Appropriation Account.

15. This type of accounting is quite out of place for a commercial organization. It gives no indication of the profitability or otherwise of the services financed by the expenditure. Neither does it show the assets and liabilities of the business. In brief, it does not help either as an instrument of control for management, or as a source of information for Parliament and the public.

Commercial Accounts

16. The decisions taken by the Government in October 1955 gave the Post Office greater responsibility for pursuing sound financial policies. They directed attention to the *Commercial Accounts*.

17. These accounts, which show the overall trading position for the year and the profit or loss on the various services, are similar to those which a company would submit to its shareholders. Unlike the cash accounts, which show actual cash

received and cash paid out in the year, the *Commercial Accounts* show income earned and expenditure incurred. For example, the cash accounts show the actual pension payments to former staff, while the *Commercial Accounts* are debited with the appropriate contributions towards the pension rights of the staff actually employed. The *Commercial Accounts* also include interest on capital, provision for the replacement of physical assets and the annual contribution to the Exchequer. There is also a Balance Sheet, compiled in accordance with commercial practice.

18. The *Commercial Accounts* are used to determine Post Office financial policy, including the fixing of charges.

The future

19. With the new proposals the year's financial results would be given in the *Commercial Accounts* alone. The confusion caused by the present system of dual accounting—cash accounts for one purpose: commercial accounts for another—would disappear. A report from the Postmaster General would accompany them. This is in line with modern commercial practice. Greater emphasis would be laid on commercial accounting as an instrument of financial control within the Post Office.

V. FINANCIAL POLICY

Revenue objectives

20. The Post Office would be required by statute to secure that its revenues should not be less than sufficient, taking one year with another, to meet its outgoings properly chargeable to revenue account. In practice a standard of performance appropriate to a publicly owned organization run on a sound commercial basis would be expected. For example the policies of providing for depreciation by reference to the current value of the assets and of making full provision for accumulating pension liabilities would continue. The Post Office would also aim to provide appropriate reserves.

Contribution to the Exchequer

21. The traditional exemption of the Post Office from most forms of taxation would continue. It would, however, be required to make an annual contribution to the Exchequer approximately equivalent in amount to the taxes it would have had to pay but for this exemption.

Capital Expenditure

22. Post Office borrowings of new capital would continue to be authorized by Acts of Parliament. At present the Post Office itself finances—through the provision it makes for depreciation—rather more than half its annual needs for the renewal, modernization and expansion of its system.

Obligations to the Community

23. Emphasis on the commercial aspects of Post Office business must not be allowed to subtract from its obligations to the community as a whole, though this may mean giving some services below cost. For example, the daily delivery of letters to scattered communities, and in some cases the provision of telephone service for them, is very expensive. Moreover, losses on inland telegrams are universal.

VI. PARLIAMENTARY CONTROL

Normal Estimates procedure to cease

24. There would be no annual authorization of Post Office expenditure by Parliament through Estimates, except for Ministers' salaries.

Effective control remains

25. But Parliament would still have plenty of opportunities for examining Post Office affairs and for satisfying itself about Post Office policy and management in general. Indeed, the information to be put before Parliament should give it a much clearer picture of what is happening than it gets now.

26. The intention is to provide that the Postmaster General's power to draw on the Post Office Fund should lapse annually unless it is renewed by affirmative resolution of the House of Commons. Moreover, each year—

(*a*) Parliament would authorize by Vote the salaries of Post Office Ministers in accordance with the normal procedure;

(*b*) the Postmaster General would be under a statutory obligation to present a Report and Commercial Accounts (in greater detail than at present);

(*c*) the Postmaster General would also give Parliament statements on—

(i) the prospects for the ensuing year;

(ii) the investment programme and the plans for financing it;

(iii) the staff employed;

(*d*) the Commercial Accounts would continue to be subject to audit by the Comptroller and Auditor General and to scrutiny by the Public Accounts Committee.

In addition—

(*e*) the borrowing of new capital would have to be authorized by legislation;

(*f*) it is intended to provide that, in future, all Post Office tariffs shall be fixed by or under Regulations subject to negative resolution; (At present some are subject to Parliamentary control and some are not);

(*g*) Post Office Ministers would continue to answer Questions in Parliament.

VII. TREASURY CONTROL

27. The 1955 changes, like those which flowed from the Report of the Bridgeman Committee in 1932, were calculated "to facilitate a less meticulous Treasury Control of the Post Office". The spirit of these intentions has had a great deal of influence on relationships between the two Departments in recent years. Treasury responsibilities have remained, however, because of the constitutional requirement that all revenue must be paid into the Exchequer, from which money can only be issued under Treasury control.

28. Treasury responsibility for the Post Office would cease except in so far as its activities affect the national economy generally, or where Post Office staff as part of the whole Civil Service are concerned. In practice this would mean that Treasury control over the Post Office would be restricted to three things—

(*a*) pay, grading and conditions of service of staff;

(*b*) investment control, including control of borrowing for the purpose of financing it (as for the public sector generally);

(*c*) foreign exchange control.

VIII. RELATIONS WITH OTHER DEPARTMENTS

29. All services to and from other Government Departments would be paid for in cash. Where the services are of a kind offered to the public (for example, the provision of telephones) public charges would apply. For other services to Government (for example, the payment of family allowances), the Post Office would be entitled to recover costs.

30. The Post Office would continue, on behalf of the Treasury, to manage the Post Office Savings Bank, National Savings Certificates and Stamps, Defence Bonds, Premium Savings Bonds and Post Office Register Stocks and Bonds. Its expenses would be reimbursed as set out above.

31. Any expenses incurred by the Post Office in connexion with Broadcasting would be reimbursed out of the Broadcasting Vote. Broadcast receiving licence revenue would continue to be paid into the Exchequer.

IX. LEGISLATION

32. Legislation to give effect to the proposals will take some time to prepare because of the complexities of the existing arrangements. But the Government hope to seek the approval of Parliament for these changes in the next Parliamentary Session.

X. CONCLUSION

33. These proposals are designed to give the Post Office a status more appropriate to its commercial nature. To achieve this some innovations are necessary. The Government are confident that, as a result, the public will benefit, partly by a clearer understanding of the basis of Post Office operations, but more practically from the incentive which the Post Office will have to adapt itself to the demands of the public and to evince an even greater sense of enterprise.

SUMMARY OF PROPOSALS

The proposals maintain direct control of the Post Office by the Postmaster General who will remain responsible to Parliament. They would complete the steps taken by the Government in 1955.

The main features are—

1. **The separation of Post Office finances from the Exchequer.**
2. **The abolition of the annual Parliamentary Estimate procedure and the Treasury control that goes with it.**
3. **Its replacement by effective—but nevertheless flexible—Parliamentary control.**
4. **Post Office staff will remain civil servants.**

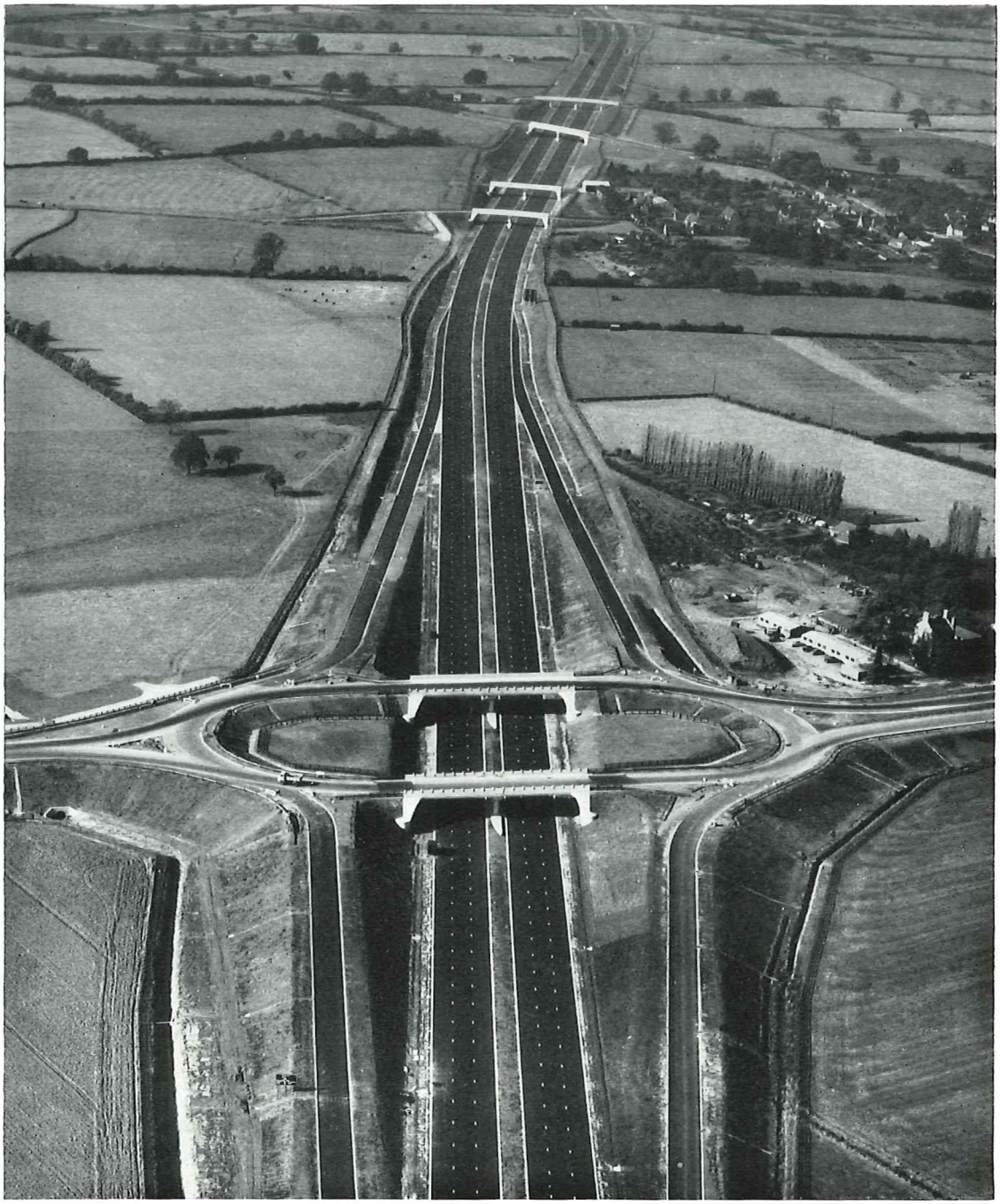


Fig. 1 : Two-level junction near Northampton
(Courtesy, John Laing & Son, Ltd.)

Telephone Communications on M.1

C. A. Richardson

COMPLETION OF THE FIRST SECTION OF British Motorway No. 1 marked an important stage in the development of our roads. Before describing the extent to which the Post Office was concerned in its construction it is interesting to reflect on the history of British roads in general. Archaeological evidence shows that roads or specially prepared ways existed in remote pre-historic times when they were used to carry articles of primitive trade such as salts and flints for considerable distances. An outstanding example is the road over which tin was carried from Cornwall to Colchester. The Romans took over many of these primitive roads, and later they incorporated them into the system of military roads radiating from Colchester and London. It was the Romans who introduced cambered and surfaced roads to our country, but after the Romans withdrew little attention was given to the upkeep of their roads until the early eighteenth century, when poor transportation facilities seriously threatened economic development arising from the Industrial Revolution.

To enable local parishes to raise money for road maintenance Parliament authorized the setting up of Turnpike Trusts which allowed parishes to levy a toll on road users. Some of these Trusts eventually fell into disrepute but the economic effect was an overall improvement in the condition of our roads, and in Scotland this was furthered by the military roads constructed after the 1715 Rebellion.

Then came the golden age of coaches. By 1830 the Post Office mail coach system had been widely adopted and speeds of 12 miles an hour were attained on roads built according to the revolutionary methods developed by Macadam and Telford. In 1845, however, Britain went "railway mad" at the expense of the flourishing coach industry, which began to decline. In consequence the conditions of our roads became less important. Not until motorized road vehicles began to be produced in great quantities was attention once again directed to the roads of Britain.

From 1925 to 1938 the density of vehicles per mile of road rose from 8.5 to 17.6. In 1946 the Ministry of Transport published a tentative plan for 800 miles of main roads. This project was shelved, however, because of economic difficulties but the number of vehicles continued to increase at such a rate that in 1956 there were 27.4 vehicles for every mile of road. In comparison the vehicle densities of the United States (20.0), West Germany (17.3), Sweden (9.4), France (5.2), and Eire (3.5) were smaller. By 1957 the United Kingdom figure had risen to 39.1 vehicles per mile of road and once again it was seen that the country's economic development was threatened by inadequate transportation facilities. But by then the Ministry of Transport's plans, revised in the light of current needs, had been approved by Parliament.

Motorways

Our main roads have always been available to pedestrians and livestock as well as all kinds of vehicles, but the Special Road Act passed in 1949 enables the Minister of Transport, or local authorities acting with his approval, to build special roads for use by particular classes of traffic only. There are various types of special road and one of them is known as a motorway, access to which is specifically prohibited to pedestrians, livestock, and low-powered vehicles. Other roads and footways must cross either under or over a motorway which, like a railway line, is fenced off from surrounding territory for its entire length. Motor vehicles joining and leaving a motorway must do so by specially constructed slip roads as shown at Fig. 1.

For a great part of its length a new motorway is usually a considerable distance from towns and villages and normal services. Ancillary facilities, such as garages and First Aid, have to be specially provided against breakdown or accident. The basic design, standards of construction, and ancillary facilities for motorways were clearly defined in 1950 by the Inland Transport Committee of the Economic Commission for Europe, the members of which declared that to establish closer relations between European countries a plan should be prepared for the construction or re-construction of roads suitable for international traffic.

They also decided that telephones should be provided at regular intervals along an international motorway so that motorists could quickly summon aid. Similar facilities are a feature on many continental autobahns and an example of the kind of telephone pillar now replacing those destroyed in Germany during the last war is shown in Fig. 2.

The first motorway in this country came into use in December, 1958. This was the Preston by-pass, part of the proposed Birmingham-Preston motorway. Because it was short, and not far from main centres of population, no emergency telephones were provided at the outset.

The next step was the opening in November last year of the first section of M.1 from Watford to Crick, near Rugby, with spur motorways M45, giving access to the Birmingham trunk road, and M.10, the St. Albans by-pass. Altogether 72 miles of motorway were opened.

POST OFFICE PARTICIPATION

Conforming to the general pattern of motorways, M.1 was planned to avoid towns and villages. It did not interfere with Post Office plant in towns, but all existing roads crossing the route of M.1 had to be altered or diverted and this necessitated considerable re-arrangement of Post Office plant. The Telephone Managers concerned were kept informed in the early stages of planning and all the necessary alterations to plant were completed without seriously affecting normal service.

Service Areas

There are to be two main service areas on M.1 each with filling stations on each side of the motorway, and restaurants and other facilities on one side only. When these service areas are completed, self-service postal and telephone facilities, including a telephone kiosk, will be provided for motorists. These facilities will be grouped together and provided as a unit designed to meet the architectural and landscaping requirements of the Ministry of Transport.

Main Trunk Routes

The possible use of the motorway verge as a route for the telecommunications plant connecting the main centres of population *en route* was considered at an early stage. Main underground plant along the motorway was not considered necessary at the outset but, to facilitate any schemes which might be required later, ducts have been provided at all bridges and crossings.

Emergency Telephones

Before deciding to provide emergency telephones, the Ministry of Transport studied accident rates on high speed motor roads in other countries and estimated the possible accident rates on M.1.

Fig. 2 : German superhighway communication Pillar (Siemens)

They also had regard for the fact that motorists on the motorway would not have access to normal telephone service. Eventually the Ministry asked the Post Office to recommend the most suitable telephone system and complete the work before M.1 opened. As construction of the motorway had already begun, this was a formidable task.

The requirements for the emergency telephones were:

(i) They should be installed at about one-mile intervals on both sides of the motorway (144 telephones in all) and be available to road users at all times.

(ii) Telephones should be easily accessible, but placed so as not to obstruct or be damaged by moving vehicles.

(iii) Users should not have to insert coins or use a dial and, in view of the circumstances in which emergency telephones would be used, operation should be simple and foolproof.

(iv) A small light inside each pillar was required to enable use during hours of darkness (there would be no supply of electric power on the motorway).

(v) The official answering a call should be able instantly to identify the pillar in use, lest the caller could not himself do so.

(vi) Efficient working was required but due regard should be paid to economy in providing cables and equipment.

These requirements were discussed between the Post Office and the Ministry of Transport, and tentative costs were prepared for a number of possible schemes. At first, the Ministry thought in terms of one reporting centre near Newport Pagnell, with private lines to each roadside telephone. On receipt of a call from a motorist, the appropriate authority—for example, Police, Ambulance, Fire or Garage—would be notified by telephone or radio. This arrangement would have meant a special building, permanently staffed by Ministry officials, and very high telephone plant costs. After some consideration, this plan was abandoned in favour of a Post Office suggestion to zone telephones according to counties, and connect them to selected police stations or headquarters in each county.

It was seen that costs could be reduced considerably by connecting a number of telephones in parallel to one cable pair, but to reduce the risk of a fault affecting telephones on both sides of a section of the motorway, the telephones on each

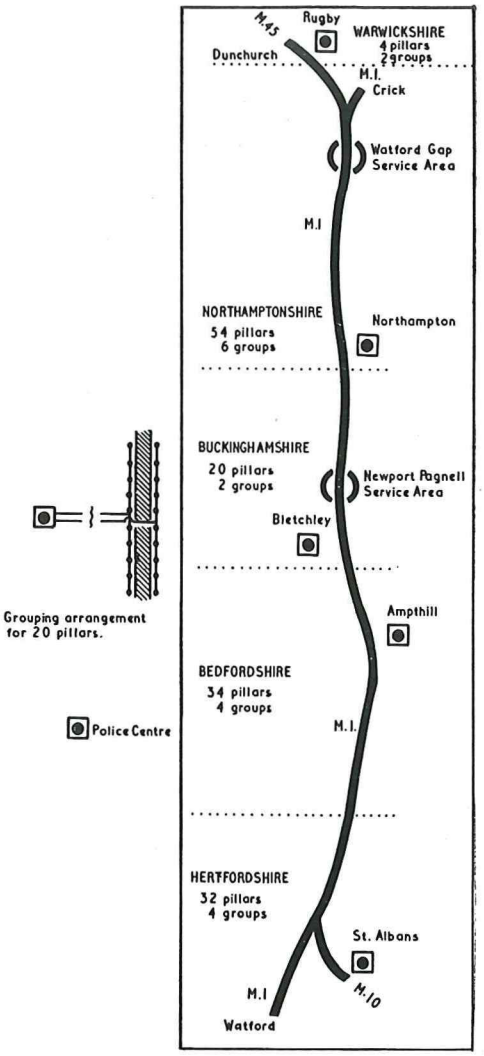


Fig. 3 : Zoning of telephones on M.1

side would have to be separately grouped. Furthermore, since there was no need for the police to call a pillar, nor for intercommunication between pillars, the number of telephones permitted in parallel could be increased beyond the normal figure by dispensing with the bell in each telephone. Laboratory tests showed that such a system was quite practicable using up to 10 CB telephones at one mile intervals, but special equipment would have to be developed to enable the police to identify the calling pillar. After consultation with

the Ministry of Transport, the Home Office and the County Police Authorities concerned, the Post Office plan was accepted and an order was placed in March 1959, for provision of the system. Fig. 3 shows the Police centres and groups of telephones in relation to the motorway.

Cabling

Plans of the motorway showed a grass verge along each side and it was agreed that this would be used exclusively for Post Office cables, which could be laid in the apparently soft earth, using mole-draining machinery. But the verge along much of the route was lately found to be of solid rock or rubble filling, and mole-draining was not possible. Trenches therefore had to be laboriously dug by hand for many miles and the cable laid in a bed of sand.

Earlier, the Ministry had been unable to overcome the motorway contractor's objections to the provision of crossing ducts between opposite pairs of telephones—if this had been possible it would have been necessary to cable only one side of the motorway, thereby considerably reducing costs—but when it was seen that the hand digging was seriously slowing the rate of progress and adding much to the estimated cost the Ministry instructed that the crossing ducts should be provided wherever possible, according to the state of construction.

Meanwhile, other contractors were feverishly trying to finish their own work by the target date, and what originally seemed a simple cabling job became a most difficult operation. Cable laying gangs had to wait until verges were graded or consolidated; cables already laid were often uprooted and severed by workmen erecting large road-signs; and with only a few days to go a two-mile section of cable was diverted to the other side of the motorway in an attempt to reduce dangerously high voltages being induced from an intermittently used overhead grid line. Post Office Headquarters and Regional and Telephone Managers' engineering staff worked as a team, however, and all essential work was finished in time for the public opening last November 2.

To assist the Ministry the Post Office offered at the planning stage to provide and install 144 standard type police pillars (Post PA No. 3), but the Ministry's Advisory Committee on the Landscape Treatment of Trunk Roads did not like the

Fig. 4 (a) and (b) : Emergency telephone pillar and cabinet, designed by Ministry of Transport for M.1

style and designed a pillar and cabinet especially for M.1. One of these pillars and cabinet is shown at Fig. 4 (a) and (b). They are painted grey-green and have blue and white reflecting signs. The front flap has a self restoring spring and when pulled down a small lamp in the top of the cabinet is switched on to illuminate the telephone and instructions. As there is no supply of electric power on the motorway, and local batteries are not required for the 300-type telephones which are used, current for the lamps is supplied by a small primary battery in each pillar.

Signalling

To meet the Ministry's requirement for a simple form of signalling from telephone pillars the CB system was employed, whereby a signal is received at the police centre whenever a handset is lifted. Dialling is not necessary. With a number of telephones grouped on one pair of wires, however, normal signalling equipment would not give the police centre the positive and individual identification signal required. Various selective signalling systems were developed by the Subscribers' Apparatus Branch of Engineering Department Headquarters, including several forms of DC signalling, one form of automatic pulsing to simulate dial pulses, and one form using VF tones. The overriding operational requirement was that the caller was to do no more than lift the telephone handset when making a call.

The system finally chosen was selected because it met fully the operational requirements of the Ministry, the Home Office and the police authorities in the most economical and satisfactory manner. The full technical details are described in an article in the *Post Office Electrical Engineers' Journal* and only a brief description is given here.

The system uses DC resistance-loop signalling, a different value of resistance being used at each of the telephones grouped on one pair of wires. At the telephone pillars the only signalling equipment required is a small resistor and rectifier, which have only a small maintenance liability. The automatic identification equipment is fitted at the police centres and consists basically of a few relays and one miniature uniselector for each group of telephones, with a form of transistorized Wheatstone Bridge. This latter electronic component "reads" the information presented by the particular value of resistance being signalled from a telephone, and causes a hunting uniselector to stop on the particular outlet associated with that value. This operation then causes the appropriate identification lamp to light on a small key-operated answering switchboard. Each pillar, with its calling lamp, has a distinguishing letter and

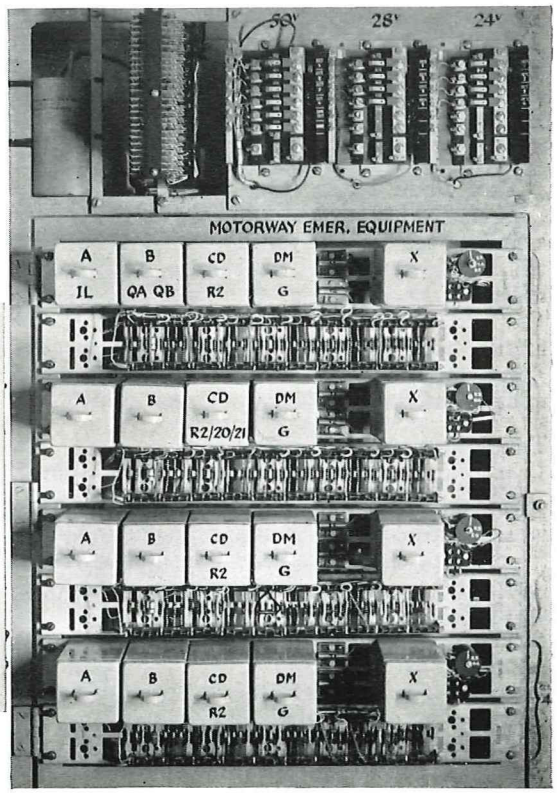


Fig. 5 (a) and (b): Table-mounted switchboard, and equipment rack, at St. Albans police station

number; the letter indicates on which side of the motorway the pillar is—"A" for north-bound and "B" for southbound—and the pillars are numbered consecutively from the London end.

Should the identification equipment fail a common calling lamp will usually indicate a call from a group of pillars, and the caller can then usually give the pillar number to the police. Fig. 5 (a) and (b) illustrates the equipment and answering cabinet in the police station at St. Albans.

Conclusion

Considering how late the firm order was placed, and the many difficulties encountered during planning and progress of the work, the successful handing over of the emergency telephone system in time for the opening of the motorway was a noteworthy achievement. The work would not have been finished on time, however, without the willing co-operation of all concerned in the Post Office, notably the Construction, Main Lines and Subscribers' Apparatus branches of Engineering Department Headquarters, and the staffs of the Telephone Managers in the Areas concerned.

It was pleasing to all to learn that the police found the system easy to operate. It was found especially useful in the weeks following the opening when on average 50 breakdowns a day occurred on the motorway. Though the Ministry of Transport regard the system installed on M.1 as essential, it is also viewed as an experiment, and the experience gained by the police, highway authorities and the Post Office will be invaluable in deciding the standards for emergency telephones when the network of motorways in this country is extended.

Telecommunication Plans for 1960-61

THE Post Office plans £97.7 million capital expenditure in this financial year (1960-61) of which it will borrow £44.4 million from the Exchequer under Money Acts and will provide £53.3 million from its own resources.

The White Paper (Cmnd. 973), *Post Office Capital Expenditure 1960-61*, shows that of the estimated total capital expenditure, £78.2 million will be allocated for the telephone service, while telegraph expenditure of £3.0 million is planned, £2.4 million of which will be on inland works, mostly telex. Sites and Buildings are allocated £12.9 million, General Service Works, £3.2 million, and Postal Installations, £0.4 million.

Trunk and Junction Circuits

Eight major trunk and junction circuits will be started at a total cost of £14.5 million. The largest is London-Scotland (radio), £881,000, followed (in order of expenditure) by Carlisle-Manchester (coaxial), £500,000, Birmingham-London (coaxial), £308,000, Leeds-London (coaxial), £289,000, Birmingham-Manchester (coaxial), £285,000, Aberdeen-Glasgow (radio for television), £254,000, Lancaster-Preston (coaxial), £175,000, and Carlisle-Glasgow (radio for television), £154,000.

The Post Office expects to add 280,000 pairs of wires, (at a cost of £20.8 million) to connect customers to telephone exchanges, and to bring service to 445,000 applicants (£21.4 million)—the highest connexion rate for four years. At April 1 there were 4,630,000 connexions of which 1,850,000 were for business subscribers.

Twelve major schemes for exchange equipment are planned at a cost of £19.8 million.

Nine major telephone buildings (exchanges or extensions) are planned, to cost a total of just over £1.9 million.

STD and Conversion Programmes

Seventy per cent. of telephones will have STD by 1966. Both the STD programme, and the conversion of the remaining 1,000 manual exchanges (at the average rate of two a week), will be completed in 10 years.

When the White Paper was presented in March, the waiting list for telephones was 48,000 (compared with 68,000 a year earlier), with 85,000 applications in hand or under investigation. Of the waiting list, 3,693 applications were waiting exchange equipment only; 40,718, lines to the exchange only; and 3,905, both exchange equipment and lines.

The overall level of capital expenditure is substantially the same as in 1959/60, although the level of demand for telephones is rising.

Training Staff in Pakistan

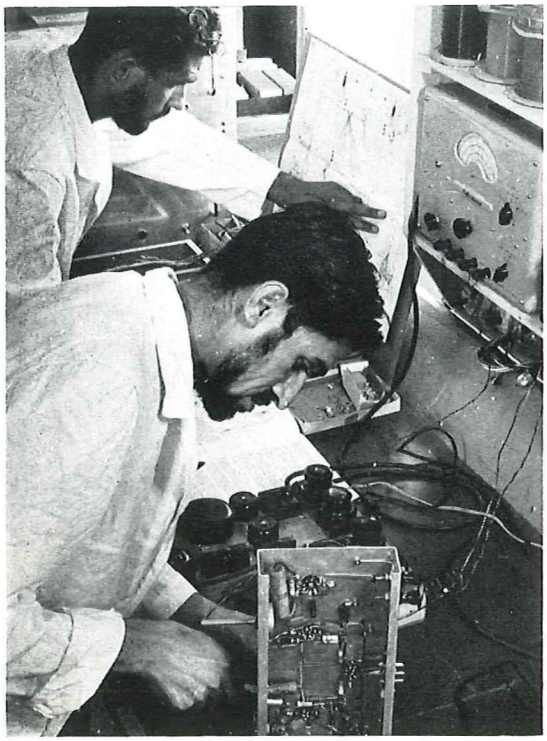
C. W. C. Richards, B.Sc. (Eng.), A.M.I.C.E., A.M.I.E.E.

"THE BODIES OF LINE STAFF WHO HAVE DIED of cholera should be carefully and thoroughly burned". We pause at our task of rewriting old Indian P. & T. handbooks into Engineering Instruction form and gaze out of the window at the shimmering plain. Sobered by contemplation of a world without anti-biotics we continue our labours and are less moved when, later in the same volume, we read: "Elephants should not be allowed to blow into their grain as this gives rise to indigestion". Such musings form the more outré fringe of a Colombo Plan expert's existence in Pakistan and his workaday job is more generally concerned with such prosaic business as explaining the elegance of detached-contact diagrams.

The most casual geographer nowadays knows that Pakistan is a country in two halves—wings either side of the triangle of India, a thousand miles apart—and this unusual configuration is not the least of the problems confronting its telecommunications administration. Pakistan's 80 million inhabitants are mainly agrarian, tilling the fertile wheat and cotton belt in the Indus basin or tending the rich jute and rice-growing areas of Bengal, and for many years the region's telecommunications needs were few.

It is true that pre-partition India had one of the most extensively developed telegraph systems in the world in terms of rural reticulation but the bulk of the traffic was carried by omnibus circuits straggling in great loops through groups of villages, using time-honoured morse keys and sounders. The telephone system was in its infancy, with all but a few of the larger towns using simple manual switchboards: it was only under the impetus of the war in Asia that the vertebrae of a long-distance network emerged. A tenuous link through Delhi provided the sole telephone contact with the outside world and "wireless" stations were simple medium-frequency installations used mainly for ship-to-shore communication. Equipment was robust and rudimentary and one competent mechanic could usually look after everything—lines, instruments and exchanges.

The emergence of Pakistan as an independent nation in 1947 meant that the entire telecommunications system had to be re-orientated with a new



Radio trainees build a superhet receiver and a crystal-controlled low-power transmitter from a kit of parts

pattern of trunk lines and services pivoted on Karachi and Dacca. Prodigious efforts were made to industrialize the land, and new and compelling demands arose for telephones, telegraph services and world-wide communication. To keep pace, the telecommunications system grew not only in size but also in complexity: automatic exchanges were installed in all major cities and in scores of rural areas as well; teleprinters took over the main telegraph arteries, and long-distance communication was vastly improved by the introduction of 12-channel carrier working and coaxial systems; high power independent sideband radio transmitters forged the East-West Pakistan link, replacing the classic SWB-8 transmitters borrowed from the Navy in 1947; direct international circuits were established between Karachi/Dacca and London, Berne, Paris, Moscow, New York (via Tangier), Cairo, Baghdad, Teheran, Jeddah, Osaka, Peking and Amsterdam.

As services expanded there came a ceaseless demand for more engineers, more technicians, more operating staff to run the system; not merely more, but better qualified and better trained. The question of training was crucial to the maintenance of a viable communications system and aid was sought from Colombo Plan sources at an early stage.

In 1951 I carried out a survey of plant and staff in Pakistan and drew up a revised training scheme that, for the Posts and Telegraphs Department, represented a complete break with the past. It was based on the assumption that some measure of specialization was imperative and that training henceforth would be a continuous process throughout a man's career—not some brief phase at the time of the recruitment—and that it would be available to all grades of staff. The scheme envisaged the establishment of three Regional Schools, at Karachi, Dacca and Lahore, with a Telecommunications Training Centre for more advanced training at a place to be selected later.

The proposals were accepted by the Government of Pakistan and the United Kingdom Government offered to help by sending me out along with a team of assistants, to inaugurate the scheme. A start was made with the three Regional Schools and the United Kingdom Government agreed additionally to supply all necessary tools and equipment.

One of the first tasks was to set up emergency training groups on automatic telephone switch adjustments as part of a drive to rehabilitate exchanges whose maintenance condition had deteriorated; "on-the-job" training courses were conducted by the British Colombo Plan experts using intensive job-instruction methods to put over thorough individual training.

Attention was then directed to the broader problem of building up the Regional School curriculum, where "ground floor" training had to be provided for rank-and-file grades such as linemen, cable jointers, telephone operators, telegraphists, telephone fitters, wiremen and teleprinter mechanics. We soon found that our efforts were hampered by the lack of adequate instructions on the standard practices to be followed and it was clear that the burden of preparing these instructions would have to be shouldered by the training organization. A system of Engineering Instructions was devised, based on those issued by the British and Australian post offices, and a publications unit was set up at the Karachi Regional School. The United Kingdom supplied off-set lithographic printing plant, process cameras and other equipment under the

Colombo Plan Technical Co-operation Scheme and an Editorial Group was organized to prepare and handle literature. Pocket versions of the basic instructions are printed in Urdu and Bengali script, which necessitates special attention to the preparation of printing masters, and extensive use is made of line drawings and photographs to amplify and illustrate the text.

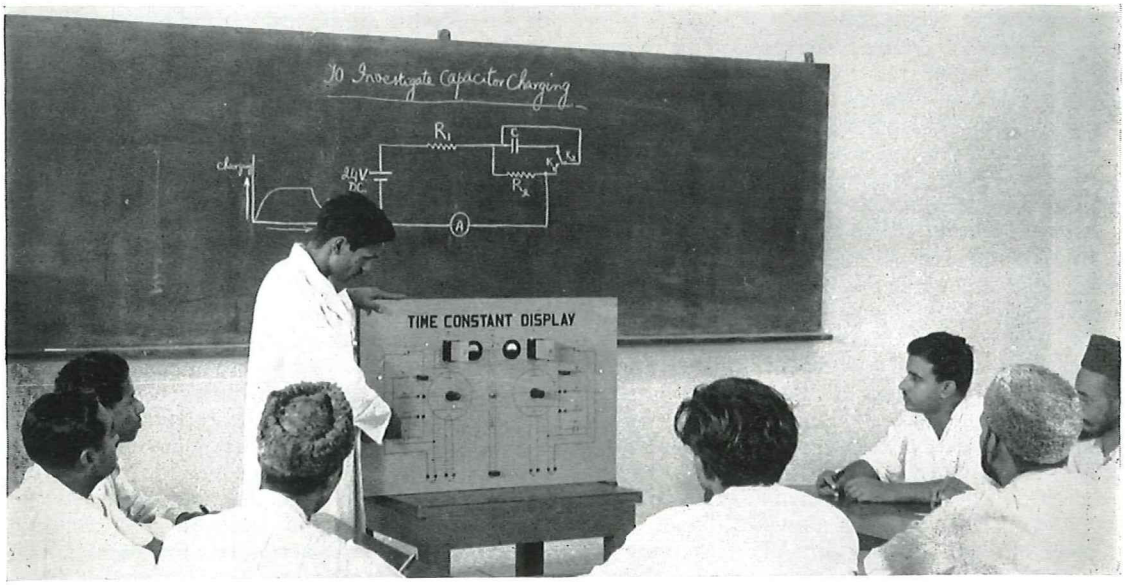
Meanwhile the Regional Schools were fitted with practical rooms housing telephone fitting bays, apparatus adjustment benches, demonstration sets, cable jointing stalls and line construction parks, and syllabus details were elaborated by British Post Office men working in close co-operation with their Pakistani counterparts. Theoretical treatment was kept to a minimum and strong emphasis was placed on practical work: instruction groups were limited to eight trainees for demonstration purposes and wherever feasible practical work was performed on an individual basis.

Coupled with the new outlook on training the Pakistan administration has accepted an apprenticeship scheme whereby the multiplicity of lower grade staff will be replaced by a new "technician" class selected from good calibre matriculates. Regional Schools play an essential part in training these technicians by providing a nine months' course in basic telecommunications, which could be described as a practical version of the City and Guilds first year telecommunication technicians' course, with the addition of workshop practice and English. No trainee leaves the Regional School without his own personal copy of the pocket Engineering Instructions relating to his duties along with a complete tool kit, the cost of which is borne by his parent Division. In this way trainees are encouraged to continue the good practices learned at the School.

After the country was partitioned in 1947 a makeshift training centre for the higher grades of work had been established at Lyallpur in the Punjab, but neither the building nor the locality was suitable for an establishment of this nature. With commendable foresight the Posts and Telegraphs Department launched an ambitious building project at Haripur in the North-West Frontier region, erecting a fine new Centre capable of accommodating 250 trainees at a time, a residential hostel, living quarters for teaching staff and amenities proper to a self-contained telecommunications colony. The United Kingdom Government matched this effort with an offer to provide equipment for the new Centre under the Colombo Plan.

The Centre has four main wings—Telephones, Telegraph Equipment, Radio and Carrier—and

The author demonstrates the use of a cable search coil to a Regional School Instructor



Extensive use is made of "live diagrams" to illustrate classroom teaching. An instructor explains the function of a static modulator

new technicians are directed into those avenues in which they have displayed greatest interest and aptitude during their basic training. English is the teaching medium, mainly because most text-books are in that language but partly because it forms a convenient "lingua franca" for students whose mother tongue may be Punjabi, Sindhi, Pushtu or Bengali. The approach is essentially practical, avoiding purely academic teaching, though it is necessary to provide considerable background material which the British Post Office trainee would acquire through part-time study for City and Guilds courses. Theoretical concepts are put over with the maximum use of training aids such as "live" diagrams, filmstrips and sound films.

The film, with its ability to establish good archetypes and to get the message across "writ large", is a potent educator on the Asian scene and Pakistanis share with their neighbours an avid interest in the cinema. A film, of course, can never supplant direct instruction but it can ensure that direct instruction conforms to the accepted pattern. To this end a start has been made on producing modest local training films dealing with basic tasks such as soldering and line construction.

One of the most formidable problems is the training of local instructors and it has been necessary to establish definitively the structure and scope of each training course by printing in detail the timetables, lesson content and demonstration and practical work plan. Wherever possible the Centre uses prototypes of the different kinds of equipment used in the field so that trainees may work on the real thing before tackling systems that are in service. When this is not practicable, such as with high power radio transmitters or coaxial cable systems, small training units under the direction of a Colombo Plan expert have been set up at the stations themselves for "on-the-job" training.

Any venture such as this must be a long-term investment; considerable outlay in terms of effort and expenditure is required now to produce results which may not mature for some years. The United Kingdom Government has contributed some £100,000 worth of equipment and material over the entire field of the training projects, and in all 12 members of the British Post Office have worked in the Colombo Plan team since 1954. To give the enterprise a truly Commonwealth flavour the New Zealand Post Office has supplied technicians' manuals and the Australian Government has given a considerable amount of radio equipment and the services of one of its Post Office instructors in carrier telephony.

Consolidation at the grassroots of instructor training remains to be done but already achievements have been sufficiently marked to merit attention from the 1959 ECAFE ([United Nations] Economic Commission for Asia and the Far East) telecommunications mission which commented favourably on the Pakistan organization and suggested that its training facilities should be made available to neighbouring countries. But perhaps the most convincing tribute comes from Divisional Engineers who are gratified to find that now, for the first time, their staffs exhibit some grasp of the job, that mistakes are fewer, lost circuit time is less, and the general standard of service is on the upgrade.

Looking back on this project one tends to overlook the difficulties, the seeming impossibles. In a search for early impressions perhaps the most abiding is a sense of isolation. The isolation stems not merely from a strange and oft-times hostile physical environment, for this is something which is commonplace to generations of British people who have served overseas—but they, at least, had their cadre of colleagues, however thinly spread, with whom they could share problems, discuss difficulties. A Colombo Plan expert is on his own among people who are friendly and eager to learn, but who have a markedly different sense of values, different standards, different modes of living and working. His paramount need is to break down that isolation so that he may make contact, not only adapting his skills and knowledge to the new task but carrying his local counterpart with him. The difficulties encountered are apt to appal those used to the ordered regimen of the Home Service and it is small wonder that the first few months of each new assignment are spent on what is laconically termed "orientation".

Of John Lawrence, that indefatigable nineteenth-century administrator, the people used to say "Jan Larens sub janta"—John Lawrence knows everything. Something of that mantle undeservedly falls on the shoulders of the British Post Office man who is expected to know everything, from the correct multiple flash exposure and screen ruling necessary to produce satisfactory half-tone blocks for Engineering Instructions, to the limits of carrier compression permissible on a high power independent sideband radio transmitter. It has been reassuring to know at times like these that the encyelopaedic resources of the British Post Office have been freely available and we never cease to wonder at the patience displayed by the Engineering Department's Consultative Services group in handling importunate calls for help from distant experts.

The label of "expert" is, in fact, one that is worn uneasily by Post Office exiles and modesty is restored only on reading a definition by Professor Tustin in a recent *Institution of Electrical Engineers' Journal* that "an expert can range from those who know everything about nothing to those who know nothing about everything". Whatever his position in the technical spectrum it is certain that no expert will succeed without a sense of historical perspective, a resilient optimism and a genuine sympathy with local aspirations. A sense of humour is just as relevant, though at times it is difficult to know on which of these qualities one should draw.

Beating off the long-legged wasps that nest in the bookcase we pick up the Accounts Code, pondering on how this least inspired of documents can be shaped into the new Engineering Instructions format. Travel claims are often as tedious as the journeys they momentarily depict but we are jogged to attention by the nice punctilio of the regulation dealing with charges for camel hire. The allowance of 5 annas a mile, it says, is admissible only when the travel bill "contains a certificate that the Government servant concerned actually travelled on camel back and that it was necessary for him to do so in the public interest". Accustomed as we have become to the bizarre and the unusual our imagination boggles at the thought of a Government servant who would travel on a camel without its being in the public interest. And we close the book freely admitting that for all the common ground between telecommunications organizations the world over the Asian scene still harbours its surprises.

C. & W. Ltd. Building First Cable-Layer

Cable & Wireless Ltd. have decided to build their first cable-laying ship—all their previous cable ships, including the seven afloat and the new 4,000-tonner being built, have been repair ships.

The new ship, which will be the second largest cable layer in the world (only the Post Office ship *Monarch* is larger), will be 7,000 gross tonnage with a steaming range of 8,000 miles; she will be capable of remaining at sea for a 60-day voyage.

Keysending from Subscribers' Telephones

W. J. E. Tobin

LAST December the Postmaster General, replying to a Parliamentary question suggestion that the Post Office should replace dial telephones by the push-button type, said that the possibilities were being studied in conjunction with the use of electronic switching in the telephone service. He agreed that push-buttons are quicker to operate than dials but added that, with the present electro-mechanical switching system, their use would not speed up the time for connecting calls, and would mean providing additional equipment at the telephone exchange, so increasing costs.

In the following article Mr. Tobin discusses the pros and cons of push-button telephones.

THE POST OFFICE, IN COMMON WITH A number of foreign telephone administrations (notably the United States and Sweden), is studying the question of what would be required to provide push-button (keysending) signalling devices on subscribers' telephones.

Push-button devices are, of course, quicker to operate than the dial which is the standard device over the whole world at present, but it does not follow that calls would be connected more quickly, as this is determined basically by the type of switching equipment used in the exchanges and the type of signalling equipment used between exchanges on multi-link calls. This exchange and signalling equipment exists in large quantities in any country that is reasonably well developed telephonically, and much depends on its nature whether it is economic or practical to make modifications to take advantage of the possibilities of push-button sending.

Automatic Switching Equipment

The types of automatic switching equipment in use throughout the world are many and varied, but in so far as this problem is concerned they fall into two classes—those that are register controlled and those that are not so controlled.

In general, with register controlled equipment the subscriber, after lifting his receiver, is connected to a register-translator-sender or a register-marker before he receives dialling tone.

The register receives the information signalled from the subscriber and then initiates all the steps necessary to route the call to its destination. These steps depend on the type of switching and signalling systems used, but in general the register is released from the connexion and becomes available for another subscriber's use as soon as it has performed its function in the setting up of the call. Thus, although these devices are complicated, they are provided in relatively small numbers.

In non-register controlled systems the subscriber, after lifting his receiver, is connected directly to a selector before hearing dialling tone, and the first train of pulses from his dial directly operates this switch which connects his line to the next rank of switches in time for the next train of pulses from his dial to operate that switch, and so on.

As stated earlier, the world-wide standard of signalling from the subscribers' instrument to the exchange at present is a dial. This varies somewhat in detail but the broad principle is that a series of direct current pulses is sent to the exchange, the number of pulses in each series representing the value of the digit to be signalled. With register controlled systems the receiving devices in the registers are designed to receive this type of signal, and in non-register systems the switches are designed so that they can be operated directly by such pulses.

Push Button Sending

With push-button sending, the single depression of a single key must send a signal to represent a complete digit, and this means adopting some form of coding that can be interpreted by suitable equipment to operate control and switching equipment to produce the desired results. This coding scheme gives push-button sending its speed advantage over dialling; for example, a period of a tenth of a second may suffice to signal a complete

digit, whereas the same period with dialling will signal only one pulse of the series required to indicate the digit.

Many methods can be adopted for push-button sending, some examples of which are: to vary the value of the current in the line according to the value of the digit; to send a different frequency in the voice range according to the digit; to adopt a form of code which reduces the number of frequencies required but makes use of combinations of frequencies to distinguish between the digits. The technical problems and the economics of these different approaches have been studied for some time and opinion at present appears to be hardening in favour of a two-out-of-five voice frequency code for digit selection.

In whatever manner push-button signalling may be provided it is apparent that the dial must be replaced by a device to generate and transmit the new code to the exchange, and at existing exchanges additional equipment must be provided to receive this coded information and convert it to the form to which the exchange equipment operates. At register controlled exchanges this equipment would be associated with the registers, and might be smaller in numbers than the registers, as it might be possible to make this equipment common to a number of registers.

In non-register systems the equipment would be associated with first selectors on a common basis. In fact, using this method the system would become a quasi-register system since the code conversion equipment would be essentially a device for storing the information sent by the subscriber in one form and sending it on in a different form.

It should perhaps be pointed out that the present British director system, although a form of register controlled system, would have to be dealt with as a non-register-controlled system, as access to the director is obtained via a directly operated first switching stage.

Clearly there would be no gain in the actual time of setting up connexions as the switching equipment still receives its information in the equivalent of

The author's idea of a possible push-button telephone

dial pulses and controls the subsequent switching and signalling systems in the same manner as always. In fact, because of the time required to convert the coded pulses into the equivalent of dial pulses a slight increase in setting up time would result.

In association with existing systems, therefore, the subscriber would not derive any benefit from keysending in the form of a speedier service and the increased interval after completion of sending before a tone was heard might prove irritating. On the other hand, it is undoubtedly easier to key a series of digits than to dial them and there is some evidence to suggest that the risk of error is reduced with keysending, particularly when a long series of digits has to be sent as with Subscriber Trunk Dialling or International Subscriber Dialling. For these reasons the possibility of push-button sending to existing exchanges has not been ruled out, and it is not being lost sight of by the Post Office in the evolution of other improvements to existing systems.

It is generally conceded, however, that the cost of the equipment likely to be used at the subscriber's telephone would exceed that of a dial, and at existing exchanges the signal conversion equipment would be relatively expensive. Some at least of these extra costs would have to be passed on to the subscriber in the form of an additional rental for the keysending facility.

In designing new register controlled exchanges the register could be designed to accept information from the subscriber directly in the form required. Moreover, if the switching system associated was a rapidly operating one, such as is obtained with marker control of fast operating switches, and if rapid signalling systems were used over trunks and junctions, the much more rapid receipt of information from the subscriber would reduce the holding time of registers and so reduce the number required. This reduction might well compensate for the additional cost incurred in registering the coded information received from the subscriber. Because of this, consideration is being given to the application of push-button sending from subscribers' telephones on the development of fully electronic exchanges which will be essentially register controlled.

It is not likely to be possible to design a new non-register controlled system to cater for push-button sending since, so far as is known, the setting of switches of any type cannot be directly controlled by any form of push-button code. A device to store the incoming information and to provide means of controlling subsequent switches must therefore be provided and then, to all intents and purposes, a register-controlled system has been designed.

All that has been said so far refers to the use of push-button station telephones. The introduction of push-button facilities at PBX manual boards can offer worthwhile savings in terms of work per call sufficient to outweigh the additional cost. This is because, in the PBX case, the delay before tone can be used by the operator for overlapping operations. These possibilities have been exploited in the United Kingdom by the use of senders which, while fairly bulky and designed to send direct current pulses of the same kind and at the same speed as the dial, can nevertheless be associated with position equipment, and operated in such a way that substantial savings in operating time result. Such senders, capable of sending either in to a PABX or out to the public network, are in use at a number of PBX's in Great Britain.

Summing up, subject to the successful solution of certain technical problems now being studied, push-button sending could be provided with existing systems at an increased cost compared with the present dialling system but with no gain in the setting up times of connexions. With new exchange switching systems and fast signalling systems it may be possible to provide these facilities at little, if any, additional cost, and at the same time to give an improvement in the setting up time of connexions. The full benefit for all calls would not, of course, be realized until the new switching and signalling systems were in widespread use throughout the network.

The Stationery Office has agreed, at the request of the Post Office, to proceed more quickly than originally intended with the re-setting of telephone directories in Bell Gothic type (described in the Summer 1956 *Journal*) in view of the considerable economy which results. The savings amount to about 12 per cent., of which 7 per cent. are directly due to Bell Gothic, and 5 per cent. to the greater use of abbreviations that the new type makes possible.

Twenty-four directories have now been re-set and at least 11 more will go over to Bell Gothic during 1960. The first local directory to be set in the new type, Fife and Kinross, has been issued.

Radio Services Department

THE RADIO SERVICES DEPARTMENT IS responsible for matters of a general nature concerning the international relations of the United Kingdom in the field of telecommunications, and for exercising the powers of the Postmaster General in regard to radio—in particular, the powers given under the Wireless Telegraphy Acts. The Department also runs the telegraph and telephone services to ships.

Under the Director of Radio Services there are two branches and the Wireless Telegraphy Section.

The Broadcasting Branch, in charge of an Assistant Secretary, advises the Postmaster General on general policy on broadcasting with particular reference to the British Broadcasting Corporation's Charter and Licence, and the Television Act of 1954 which set up the Independent Television Authority. It is also responsible for the broadcast receiving licence system and the general direction of measures taken against people who use receiving sets without licences, and for issuing licences to relay companies for distributing programmes by wire to subscribers.

The Radio Branch, in charge of an Assistant Secretary, deals with questions of radio policy, apart from those special to broadcasting. It collaborates with the Foreign Office and other Government departments in dealing with legal and political questions relating to telecommunications in the international sphere, especially matters concerning the International Telecommunication Convention and United Kingdom membership of the International Telecommunication Union. It issues licences under the Wireless Telegraphy Acts for most types of civil radio station. The Branch is also responsible for legislation and other measures to deal with electrical interference to radio.

The Wireless Telegraphy Section, in charge of the Inspector of Wireless Telegraphy, is responsible primarily for radio services to ships.

A world-wide telegraph service is provided through the Burnham-Portishead stations: 11 other radio stations around the coast not only speak to ships by morse but also enable ships within about 300 miles to speak by telephone to subscribers at home. The stations provide ships with weather forecasts, navigation warnings, medical advice, and a direction-finding service. They also keep a constant watch on the distress frequencies used for sending SOS messages.

In addition to these, there is one unattended station providing a short-range telephone service.

The Wireless Telegraphy Section has direct executive responsibility for the stations. Its staff also issue ships' wireless licences, inspect wireless installations in ships and conduct examinations for ships' radio officers and radio amateurs.

Left to right: Mr. T. A. DAVIES, O.B.E., Inspector of Wireless Telegraphy; Miss P. BRIDGER, M.B.E., Assistant Secretary, Broadcasting Branch; Mr. W. A. WOLVERSON, C.B., Director; Mr. H. A. DANIELS, Assistant Secretary, Radio Branch. (*Mr. Wolverson's new appointment as D.D.G.: see page* 148)

Radio Forecasting

J. K. S. Jowett, B.Sc.(Eng.), M.I.E.E.
and
G. O. Evans, B.Sc., A.M.I.E.E.

DURING RECENT YEARS PRACTICALLY EVERYone in this country has become familiar with the use of weather forecasts and even with the form of forecasting charts. This subject is one of endless speculation and personal interest to the inhabitants of the United Kingdom, and the Press, sound radio and television all provide forecasts giving information about the weather we may expect during the next 24 hours. In contrast to the weather, short-wave radio communication is of passing curiosity to most people and its technical aspects at least are normally left to the specialist. It is not therefore surprising that the practices of predicting what particular frequencies will be most useful for communicating by radio with various parts of the world, and of forecasting short-wave radio conditions generally, are known only to a few.

Radio conditions and the weather are however not entirely unrelated. The propagation of very high frequency waves is known to be enhanced generally under anticyclonic conditions which conduce to stable weather. We may also say that even short-wave communications are governed by atmospheric conditions. But in relation to radio we refer to conditions in that part of the earth's upper atmosphere which is very rarefied and exists as a number of electrified regions of the ionosphere, some 30 to 300 miles or more above the earth's surface. In these regions there are ionized layers capable of reflecting back to the earth radio waves which would otherwise travel onward into outer space.

The density of these layers and hence the effectiveness of the ionosphere in reflecting radio waves depend largely on the intensity of the ultra-violet light from the sun which varies with the well known—but still unexplained—11 year sunspot cycle. In addition the reflecting properties of the ionosphere vary with time of day and season of the year.

Now the frequencies of transmission that can be used for communication over a given circuit depend directly on the reflecting properties of the ionosphere. These properties vary markedly according to the intensity of solar radiation, the height of the sun above the horizon (and thus the time of day) and other complicating factors. Hence the radio engineer must be able to forecast the state of the ionosphere for the particular time, both hour and season, and for that part of the sunspot cycle in which he is interested.

In describing the different types of forecast used by radio engineers it is helpful to draw analogies, as far as they apply, with the more familiar terms used in weather forecasting. Thus, in radio forecasting, we can distinguish between the long-term forecasts, which are made several months and sometimes several years ahead and which can readily be regarded as long-term predictions of "radio climate", and the short-term forecasts, made only a few days in advance which correspond more closely to the meteorologist's daily weather forecast.

Long-Term Radio Prediction

Let us take a look first at the long-term predictions. If we had to deal only with the regular seasonal and daily variations of the reflecting properties of the ionosphere we could forecast the state of the ionosphere for any future month and time of day simply by looking up past records, just as we may consult tables for times of sunrise and sunset or of high and low tides. Complications arise, however, because the reflecting properties of the ionosphere change so greatly as the sunspot cycle changes from minimum to maximum and back to minimum again; the long-term forecast has therefore to take account of the expected future trend of this cycle.

Although the sunspot cycle is generally referred to as an 11 year cycle it is only approximately so. Fig. 1 shows the variation of the yearly average sunspot numbers: that is, the averages of the number of spots on the sun over the period 1760 to 1958. This diagram shows that the time between successive minima of the cycle can vary between 9 and 13 years and also that there is considerable variation in the amplitude of successive maxima. Many attempts have been made to fit the variations of the maxima to a definite law which can be

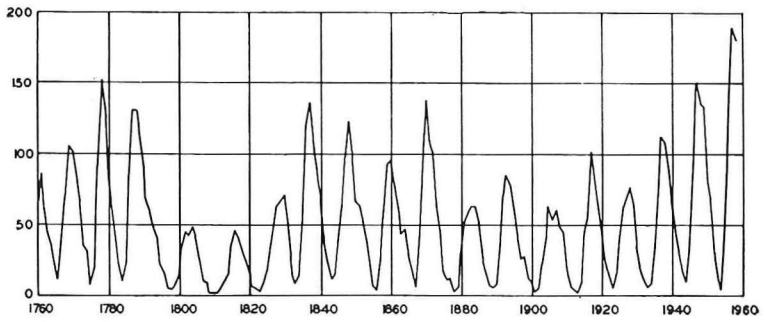


Fig. 1 :
Yearly average
Zurich sunspot number
1760-1959

expressed in terms of a mathematical formula but the general consensus of opinion at present is that they appear to be random and that the amplitude of the maximum of the next cycle cannot be predicted with any degree of confidence.

This random and sometimes very large variation in the amplitude of the maxima of the sunspot cycle illustrates the difficulty of forecasting conditions many months ahead. For this reason the preparation of routine monthly forecasts has generally to be restricted to a period of about six months. Nevertheless, forecasts of conditions several years in advance are frequently required, particularly for circuit planning, and often such forecasts have to be made on arbitrary assumptions as to future variations on sunspot activity.

The range of frequencies which can be used for communication over a given circuit at a given time is bounded by an upper limit beyond which waves will not be reflected back to the earth, and a lower limit below which the waves, although reflected, are subject to excessive attenuation and become mixed with too much atmospheric noise. Both the upper and lower limits undergo seasonal and diurnal changes over a sunspot cycle but the variations of the lower limit are relatively small, although they cannot be neglected. In this article we shall discuss only the forecasting of the upper limit.

Need for Long-Term World Wide Data

When forecasting the upper limit of the range of usable frequencies we are required to predict the highest frequency that can be used for communication between any two points at any given time. To do this we have to accumulate past data on the reflecting properties of the ionosphere so that the future trends of these reflecting properties with changing sunspot number can be estimated. Data of this nature have been recorded over 30 years by a number of ionospheric observatories in different parts of the world. In the early years few such observatories were operating; among them were the Radio Research Station at Slough, the Australian Observatory at Watheroo, and the American Observatory in Washington.

However, during the past 10 or 15 years, and particularly during the past two years, as a result of International Geophysical Year* activities, the number of observatories working has increased considerably.

It will be appreciated that the period of 30 years represents only three sunspot cycles and that even the 20 or so sunspot cycles during the past 200 years during which the sun has been observed systematically represent an infinitesimally small portion of the total number of cycles that have occurred in the past. Furthermore, as Fig. 1 shows, the past three cycles have all been cycles with high maxima and do not represent average conditions. We have therefore only a very small sample of data on which to base predictions covering periods several years ahead. Nevertheless, it is quite essential that the collection of further data should be pursued energetically, not only to increase our knowledge of conditions and extend the period for which measurements are available but also to provide the latest possible information for future prediction purposes.

Measurements of the reflecting properties of the ionosphere are made by ionospheric sounding equipments which transmit very short bursts of radio waves of various frequencies vertically upwards to the ionosphere and measure the highest frequency on which an echo is returned; they also, from the echo delay, deduce the height at which reflection takes place. These ionospheric sounders

**Mr. Evans discussed "Long-Distance Radiocommunication and the International Geophysical Year" in our Autumn 1957 issue.*

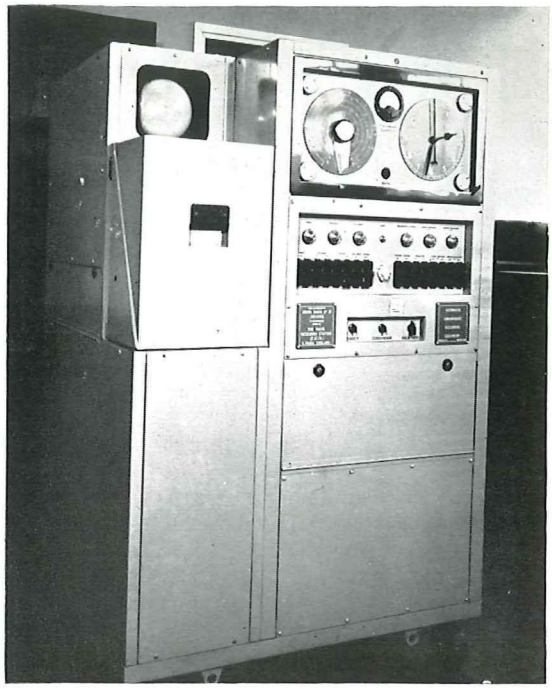


Fig. 2 : Ionospheric sounder in use at the Radio Research Station, Slough
(Courtesy, Director D.S.I.R. Radio Research Station)

were in fact the forerunners of the first radar equipments.

Fig. 2 shows an ionospheric sounder in use at the Radio Research Station, Slough. Every hour this recorder automatically measures the range of frequencies that can be reflected from the ionosphere and the heights at which the reflections occur. The data thus obtained are pooled with similar data from other observatories and are eventually used by a number of organizations to produce forecasts or predictions of future radio propagation conditions.

The data recorded at the ionospheric observatories refer to signals which are reflected back to the transmitter, but we are interested in transmissions between two points at a considerable distance apart; that is, in oblique rather than vertical transmissions. The data obtained from vertical measurements can, however, be fairly easily converted into a form suitable for use in forecasting for long-distance circuits.

This is done by multiplying the vertical frequency by a factor which depends on the distance over which the signal is to be transmitted and the height at which reflection takes place in the ionosphere. The new data obtained thus is plotted on contour charts for a standard distance of 2,500 miles, which is about the maximum distance that can be covered by a single reflection.

Fig. 3 shows a typical forecast chart. It shows, for any point on the earth's surface, the highest frequency that can be used for transmission over a distance of 2,500 miles when reflection takes place directly overhead. Charts of this type are prepared for the even hours throughout the day, the example shown being prepared by the Department of Scientific and Industrial Research at the Radio Research Station, Slough, for 0000GMT in January 1960. These charts, of which some 100 sets are distributed from Slough every month, together with similar charts showing the highest vertical frequency that can be reflected for the ionosphere, are issued to the various operating organizations. They are then used by the operating organizations to predict the maximum, or upper limiting, frequencies for the particular circuits in which they are interested.

Fig. 4 shows a typical prediction giving the range of frequencies that can be used for a radiotelephone service between London and Johannesburg during January 1960. The upper limiting frequency at 0000GMT has been obtained by superimposing on the chart shown in Fig. 3 the great-circle path from London to Johannesburg and reading the frequencies at points distant 1,250 miles from each end. The lower of these two frequencies gives the upper limiting frequency.

Short-term Radio Forecasts

So far we have dealt with long-term forecasts. We have now to consider short-term forecasts of radio conditions, which correspond rather closely to the familiar daily weather forecast.

It is well known that long-distance propagation of radio signals is subject at times to interruptions which may or may not be associated with sunspots. These interruptions are caused by disturbances in the ionosphere which fall into two types.

The first type, which results in a sudden and at times complete disruption of all radio circuits traversing the sunlit half of the globe, is caused by an intense burst of ultra-violet light emitted from solar flares: that is, large eruptions of glowing gas from the sun. These flares are liable to occur in the neighbourhood of large sunspots and may last for up to half an hour or more. A solar flare can always be associated with the occurrence of a large sunspot

but the reverse is not true; hence, the observation of a large sunspot does not mean that solar flares, causing sudden interruptions of radio circuits, will inevitably follow.

Now it appears that the same solar flare also emits a stream of electrically charged particles which travel with a velocity very much less than that of light and may, if the stream is directed towards the earth, reach it from 20 to 40 hours after the onset of the solar flare and give rise to the second type of disturbance. This takes the form of a temporary destruction of the reflecting properties of the ionosphere and interrupts radio circuits passing through regions of high latitude. It is often also accompanied by magnetic storms and displays of the aurora.

These disturbances in the ionosphere may be compared with the day by day changes in the weather, quiet ionospheric conditions corresponding to fine weather and ionospheric disturbances corresponding to stormy weather. We cannot forecast the short interruptions occurring simultaneously with solar flares with any certainty. All that can be said is that if a large spot appears on the sun there is a possibility of disturbed radio conditions, and that these conditions are most likely to occur during a period from two days before to four days after the date of central meridian passage of the spot; (that is, the day on which the spot is approximately directly opposite the earth). If a solar flare does occur then, again there is a possibility, but no more, of a radio circuit disturbance occurring from 20 to 40 hours later. Nevertheless, it is now well known that radio circuit interruptions of this first type occur mainly during the years around the peak of the sunspot cycle. But since any such forecast must depend first on a large sunspot being observed the forecasts

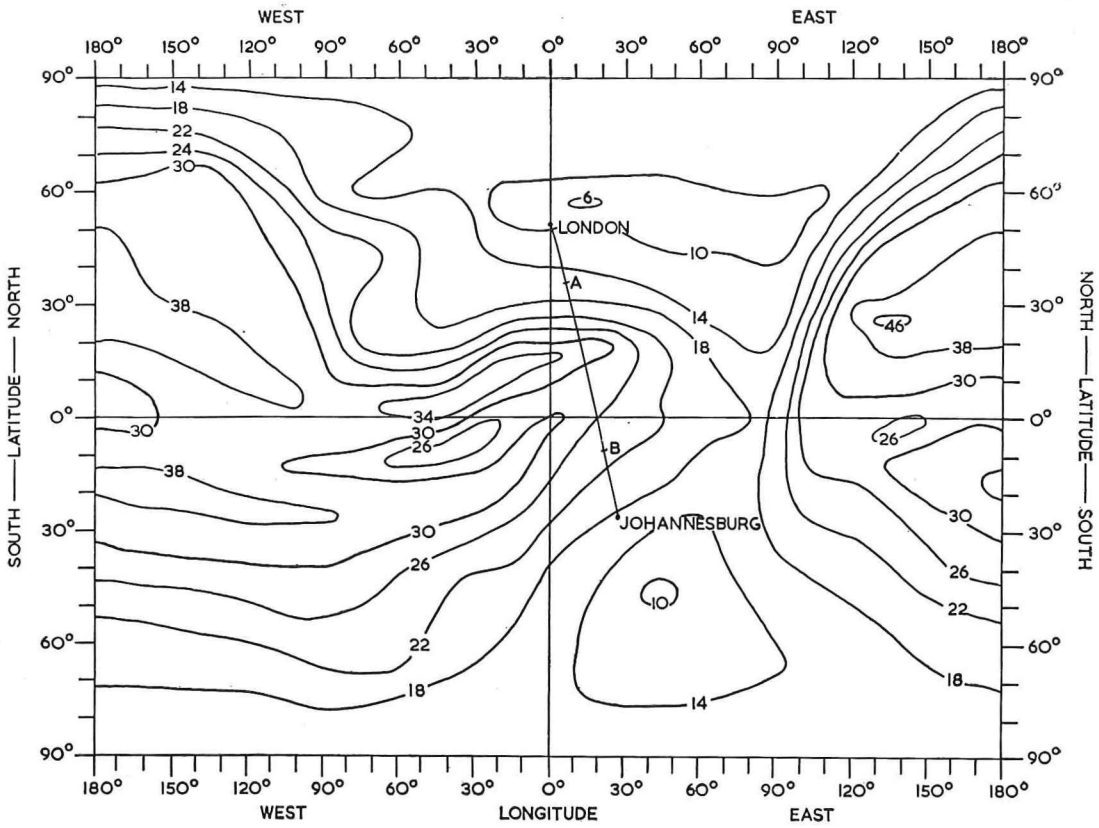


Fig. 3 : Typical forecast chart prepared by the Department of Scientific and Industrial Research with London-Johannesburg great circle path. A and B are points distant 1,250 miles from the terminals

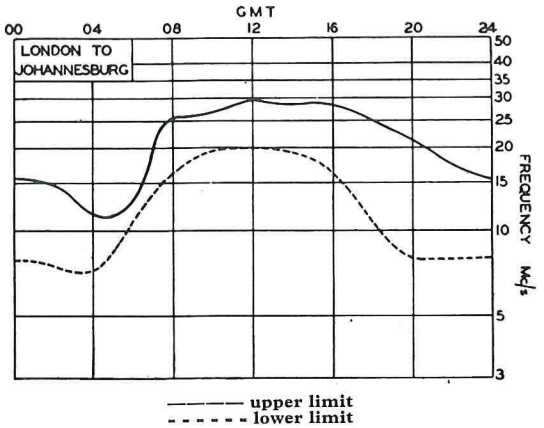


Fig. 4: Predicted upper and lower limiting frequencies for London-Johannesburg radiotelephone circuit, January 1960

cannot usually be issued more than two or three days in advance.

The second type of disturbance—caused by the arrival of electrified particles—can and does sometimes occur in the absence of sunspots. Nevertheless, since this type of disturbance often tends to recur at intervals of 27 days, the approximate period of the sun's rotation, this fact can be used to forecast its recurrence. This is done by keeping a daily record of the degree of disturbance of the earth's magnetic field, a factor which is closely associated with disturbances in the ionosphere, and by plotting the data on a chart whose time scale is 27-days wide. If a 27-day recurring disturbance is present a pattern of vertical lines is formed which shows up on successive 27-day time scales.

The onset of a 27-day recurring disturbance cannot yet be forecast, but once a disturbance has been identified as being of this type fairly accurate forecasts of disturbed periods can be made. Exactly how many recurrences of the disturbance will take place cannot be predicted but the usual number is four or five.

The reliability of short-term forecasts based on the 27-day recurrence tendency is considerably better than that of short-term forecasts based solely on the appearance of large spots on the sun's surface. Since, however, the 27-day recurrence tendency is clearly noticed only during the declining phase of the sunspot cycle, this tendency can be used for no more than a period of about five years out of the 11 years of the complete cycle. But as this is the period during which radio circuits are most seriously interrupted the forecasts based on this system can be of real value.

Extensive use is made of forecasts of propagation conditions in planning and operating long-distance radio circuits. One of the main uses is in the operation of multidestination Press services where, in contrast to the point-to-point services, the circuit is outgoing only and serves a number of widely dispersed recipients. Another important use is in communication with ships and aircraft. In operating such services the schedules of the frequencies to be used have to be worked out well in advance to allow time for sending the information to the recipients.

On the point-to-point telephone and telegraph services the long-term predictions, prepared about six months in advance, are used as a guide to enable the operator to foresee the need to make frequency changes at particular times of the day and night.

Short term forecasts of disturbed conditions can be used to set up, in advance, alternative emergency routes, one example being the use of a relay station.

Opinions about the precise value of short-term disturbance forecasts vary from organization to organization and differing attitudes are also shown by different countries. In this country, although the basic long-term predictions are provided by the D.S.I.R. as part of their normal commitments, the short-term storm forecasts are issued by individual operating organizations.

New features of the sun's effects on the earth's ionosphere are being brought to light every year. Moreover, man's exploration of space must surely increase the rate at which new knowledge of the earth's atmosphere and of the propagation of radio waves is being gained. It is therefore not impossible that within five or ten years sufficient information will have been gained to place the short-term forecasting of radio disturbances on a much more reliable basis. But even when that time comes—if it does—we shall not have prevented the disturbances; we shall merely know when to expect them so that arrangements can be made, perhaps at very short notice, to cope with them in the most economical manner.

Mr. D. A. Barron

We regret that in our Spring issue we inadvertently reported that Mr. R. J. Halsey, Director of Research, had become one of the Deputy Engineers-in-Chief of the Post Office. The name should have been that of Mr. D. A. Barron, M.Sc., M.I.E.E.

Telephone system must be developed and more used

Following are extracts from the Postmaster General's speech on February 17 to the Telecommunications Engineering and Manufacturing Association:

THE POST OFFICE IS A GREAT PUBLIC UNDERtaking. It is not a social service like the Health Service. It is not financed by taxation. It is financed by its customers.

I am determined that the Post Office shall be treated not as a financial appendage of Government, but rather as an independent commercial organization, with its own trading fund, master of its own house. If, as I believe, we can bring that about we shall have a much greater incentive to modernize and develop our business: a greater incentive to approach our problems with a business mind: a greater incentive to use up-to-date financial and statistical criteria to discover where we are strong and where we are weak.

Total investment in the public sector—as we call it—has more than doubled during the past ten years. So has that of the Post Office. Ten years ago we were allowed £45 million. Now we are being allowed £98 million.

What is more, we plan to spend £270 million on development during the next two-and-a-half years or so. And we are expecting to raise no less than £150 million of this from our own resources.

The two big challenges that face the Post Office are, first, to develop the telephone system, and, second, to step up the use of the telephone. These aims are partly related and we mean to tackle them both.

The first is largely a matter of capital. Of course, I should like more capital investment for the telephone service. I want more money for telephones. The present position is absurd. The motor car, like the telephone, is largely used as a means of communication. The capital cost of a car is ten times greater than a telephone. Yet while you can buy a car for the asking you often need the patience of Job if you want a telephone.

I do not necessarily want to borrow more money; we are already financing more than half our capital expenditure out of revenue. The trouble is that nearly every other Minister in the Government with a department to run, or a nationalized industry in the rear, wants more capital investments. My predecessor as Postmaster General wants more money for roads and railways; the Minister of Health no doubt wants a lot more money for hospitals. The assessment of these claims involves not only considerations of profitability but also of social values.

But I shall continue to press the demands of the telephone service to the greatest possible extent. Insofar as it is a matter of providing telephones for business users, I think I have an excellent case; 40 per cent. of present demand is from business, and we are meeting, and have met, most of it as it arises. Incidentally, I think many business firms would do well to consider the comparative costs of communication by post and by telephone.

Low Calling Rate

Where I am in difficulty is when I come to the residential applicant. We are still faced with a deplorably low calling rate. Our customers just don't use their telephones. The rate in Canada, the United States and Sweden is about 1,700 to 1,000 calls a year per telephone. Here, including business users, it is only just over 500. It costs us capital of about £110 to provide a telephone for the residential subscriber. He then uses it, on average, to make about one call a day!

Why is this? Many thousands of people who would never dream of using a refrigerator as an ornament seem to look upon a telephone as one. Why? I don't know. Do you? Is it because the people you want to 'phone are not on the 'phone? Is it because the service is not quick enough? Is it because people shy away because of the cost of the calls? My business is to ferret out the right answers to these questions and to act upon them.

Two things, however, seem to me to be quite clear. The first is that we must get people to use the telephone more. This is a good thing for us because residential subscribers make most of their calls outside peak periods and, in so doing, they use equipment and junction cables which have to be there anyway to meet the pressure at peak hours.

More and more mechanization, the extension of Subscriber Trunk Dialling, the Friendly Telephone—at least, I hope it's friendly—the extension of Freefone, the increased variety of information services and the Credit Card system—all these are practical means by which we are trying to make telephoning quicker and easier. "Why not cheaper?" you may ask. Well, I don't regard the present pattern of tariffs as sacrosanct by any means.

Cost of Provision Must be Reduced

The second thing is to reduce the cost of giving telephone service. I'm afraid this may not be so popular with you because, to the extent that we make switches in a telephone exchange do more work, it means smaller orders for you. But you know our approach must really be more fundamental than this. We must advance together on the technical front so that—taking full advantage of all the post-war advances in the scientific field—we develop radically new and less expensive ways of doing things.

The best of all our co-operative ventures for the public so far has been the all-electronic exchange, which we are developing in partnership with five manufacturers—and I salute them all—through the joint committee appropriately known as JERC. The working model at Dollis Hill is still being put through its paces and we shall not open the electronic exchange at Highgate Wood for public service until it has passed the most stringent tests.

Cable Development

But, you know, it is outside the exchange where ultimately we must look for the greatest savings—under the streets where most of our £110 lies buried in the form of cables containing a separate pair of wires for each subscriber.

Engineers all over the world have been struggling for a very long time to repeat in this field of local distribution the startling success which they have had in keeping down the costs of long-distance speech transmission. The coaxial cable made trunk circuits cheaper to provide than they were before the war. The experimental small bore coaxial tube, with transistor amplifiers, is making these techniques applicable for shorter distances. If ever we reach the stage when they can be applied for local distribution—if only as far as electronic switching boxes in the streets—then the connexion of every house to the telephone should be as much a matter of course as its connexion to the water or electricity.

In the next year or so the main emphasis will be on trunk plant for Subscriber Trunk Dialling and connecting new subscribers.

In the past year trunk traffic has been running about 10 per cent. higher than in the previous year. Never have we had it so good. If this rate of increase goes on we shall have to do something to add new cables and increase the circuit capacity of our existing cables. We are increasing the capacity of some of our coaxial cables to 2,000 conversions per pair of tubes.

Improved Programme for STD

We have been able to improve on our original programme for extending STD. Trunk calls will be diallable by subscribers on 90 exchanges by the end of the coming financial year. By 1965 60 per cent. of all telephones will have STD. By 1970 90 per cent. will have it.

Demand for the telephone is buoyant. This year it exceeds 400,000—the highest for four years—and 40 per cent. of that demand is for business telephones. We have between 80,000 and 90,000 orders in the pipeline. We are installing telephones at the rate of about 400,000 a year.

Merchandising

More and more we are setting out to market the telephone service. During the past twelve months we have started a new Merchandising Branch to control the development of new apparatus for our customers and to modernize present apparatus.

We have decided on a more progressive modernization programme for telephones, setting a limit to the physical life of old instruments. That will mean substantial purchases of new telephones. I now want to stimulate sales of the new coloured telephones. I have today announced a reduction in the charge from £5 to £3.

Telex is going ahead well and we are going all out to sell it. All the inland systems will have twopenny telex by the end of this year, and telex dialling to major Western European countries should be completed during 1961. For this there is a great future in the business world.

Teleprinters for Fire Brigades

A. H. Johnstone

E. N. Jack

IN SEPTEMBER 1957 SURREY FIRE SERVICE ASKED the Post Office to suggest a method of centralizing emergency calls at Divisional Headquarters, mainly to save manpower. A teleprinter network appeared to be the only satisfactory solution but as this was a revolutionary departure from the long established system of private speech circuits the Service had to be convinced of its efficiency.

Accordingly, after a time and motion study of the duties of the watchroom telephone operator (fireman), the speed of attention, stage by stage, from receipt of the call at the telephone exchange, and the transmission of the actual message by the watchroom fireman to the officer-in-charge of the fire engine, a demonstration three-station teleprinter network was set up. Extensive tests were carried out, followed by a six-months' experiment in the Metropolitan Division. Within one month the Service asked the Post Office to prepare a county scheme.

Surrey Fire Brigade

Surrey County Fire Brigade serves the administrative county which has an area of over 700 square miles and a population of about 1½ million.

The Brigade's functions are fire prevention, saving life, and controlling and extinguishing fire.

These functions are not comparable to any other sections of public service. For the most part they are undertaken in the full light of publicity, in circumstances of distress and sometimes tragedy, at times, in places, and in conditions of which there is no prior knowledge. Fire is unique in that its effects are never static, it is cumulative, with a rapidly worsening condition until controlled, and time is vital.

Surrey Brigade, with Headquarters at Reigate, has a professional establishment of some 800 men and 24 women, with a retained (part-time) establishment of about 300 men. At present there are 28 wholly professional stations and 17 retained stations, divided for organization, fire cover, and communications into three Divisions: "A", consisting of the County's densely populated Metropolitan area, with Headquarters at Wimbledon; "B", the south-eastern part of the county centred on Reigate; and "C", the western part with Headquarters at Guildford. This organization is being reviewed with the object of centralizing fire fighting control and communications.

The Brigade has 84 fire engines, six turntable ladders and 18 ancillary vehicles, all immediately available to attend calls. Arrangements also enable immediate reinforcements from the nine neighbouring brigades.

Apart from fire fighting, the Brigade deals with many other emergencies. The Emergency Tenders in each Division are equipped with a wide range of special equipment such as lifting and cutting gear, mobile lighting sets, jacks, sheer legs, Neil-Robertson stretchers, bolt croppers and the like. Accordingly, the Brigade can deal with emergencies such as train collisions, aircraft crashes, persons trapped in caves and lifts, and other accidents.

Other special services include pumping out flooded premises and boats; dealing with leakages of obnoxious and dangerous gases, supplying water for domestic and agricultural purposes; and removing objects as diverse as meteorological balloons in trees, brushes and birds in chimneys, and cats up trees. These services are charged for unless they are humanitarian or otherwise in the public interest.

Origin of Fire Calls

During 1957–58 the Brigade was called to more than 8,000 incidents, involving attendance at an average of 24 occurrences a day. About half were normal fires and a further quarter chimney fires. There were 425 calls for special services—including eight for assistance in film making. During the 1959 drought, occurrences reached 200 a day.

A single incident may involve several telephone requests from different people. About 95 out of every 100 calls are received over the public telephone network; three out of every 100 are made by people running to a fire station. About 11 of every 100 of the total calls are false alarms, but nearly half of these are classed as with "good intent" which the Brigade welcome because a fire can often be stopped in its incipient stages or before it actually breaks out. Five false alarms out of nine are malicious; almost all malicious calls are made over the telephone.

By far the greater proportion of all outbreaks of fire occurs in residential property—more than half of all fire calls are in this class—and the next highest, a quarter, are for heath, grass and commons. Both these kinds of fire, more than any other, are caused in no small measure by human failure and carelessness. The most common causes are failure to have the chimney swept, children playing with matches, smoking, and sparks from locomotives.

One or more appliances are sent in response to a fire call. One may go to a chimney, rubbish or grass fire, two to a normal premises fire and up to ten for a special risk such as an oil storage depot.

A caller reporting a fire cannot always describe exactly its nature and extent. To ensure that enough appliances are despatched without delay, the Brigade has a predetermined first attendance card for reference. By consulting the appropriate card the Mobilizing Officer knows the type and number of appliances to be sent; no deviation is allowed, and no further reference is necessary. A number of factors can, however, affect these arrangements; for instance, a station may already be attending a call and another station has to be ordered, or special equipment and appliances may be required for an incident such as an aeroplane crash or a petrol tanker alight.

Before centralization, the local station receiving the call, or partly that station and partly another, made the first attendance. To turn out the necessary full attendance, the local station often had to call its Divisional Headquarters with details; Divisional Headquarters also had to contact the station from which the other appliances were required and repeat the information to them. This obviously tended to make for some delay. Centralized control overcomes this difficulty as the Mobilizing Officer can ensure that the full predetermined attendance is ordered immediately by sending messages to the nearest Fire Stations by using the direct circuits.

Telecommunications

Before the centralized system was installed last summer the Brigade's internal network provided, in general terms, for acceptance of emergency calls to the Fire Brigade at a local fire station. Such calls were normally received at each whole-time station and a special exchange line telephone was provided for this purpose. Whole-time stations were linked by private speech circuits to their respective Divisional Controls; similarly, each Divisional Control had private wire communication with Brigade Headquarters; whole-time stations also received calls for the retained stations and warned the retained men by remotely controlled sirens and call bells.

Before 1953 street fire alarm posts invited the public in most large towns to give the alarm. Apart from economy, one of the main reasons for abolishing these was that far more malicious than genuine calls were received. In 1948 only 7 per cent. of calls were genuine; in 1949 this fell to 4.5 per cent. Genuine calls became the exception rather than the rule.

Speaking by radio from Headquarters to appliance on ground

A further means of communication maintained by the Brigade is a joint Very High Frequency radio scheme shared with Surrey County Constabulary. The Brigade has a main transmitter and receiver at Reigate Headquarters with listening posts at Divisional Headquarters, and 54 mobile units fitted to fire appliances and other vehicles. This number of mobile sets will probably be increased in the near future by a further 50 units.

A fire engine proceeding to a fire switches on its wireless equipment as it leaves the station and tells Headquarters Control that it is on the way. Any subsequent messages from the fireground are also transmitted by radio to Brigade Headquarters, which controls the movement of appliances by the same means. Fire fighting parties are thus in touch with their Headquarters at all times and requests for reinforcements can be made and met without delay.

The fireground control vehicle also carries a number of "Walkie-Talkie" wireless sets for close control of fire fighting operations at any large incident.

The New System

The Post Office suggested that communications for the whole of the Brigade should be centralized on Reigate Headquarters and that teleprinters instead of telephones should be used for passing mobilizing messages to stations—a completely new concept in the Fire Service.

The Post Office view was accepted and on July 6 1959 the first stage of the new system was introduced in the Metropolitan area of Surrey, in which there are 12 professional (whole-time) stations and one retained station. The system is now being extended to the rest of the county.

Telephone Component

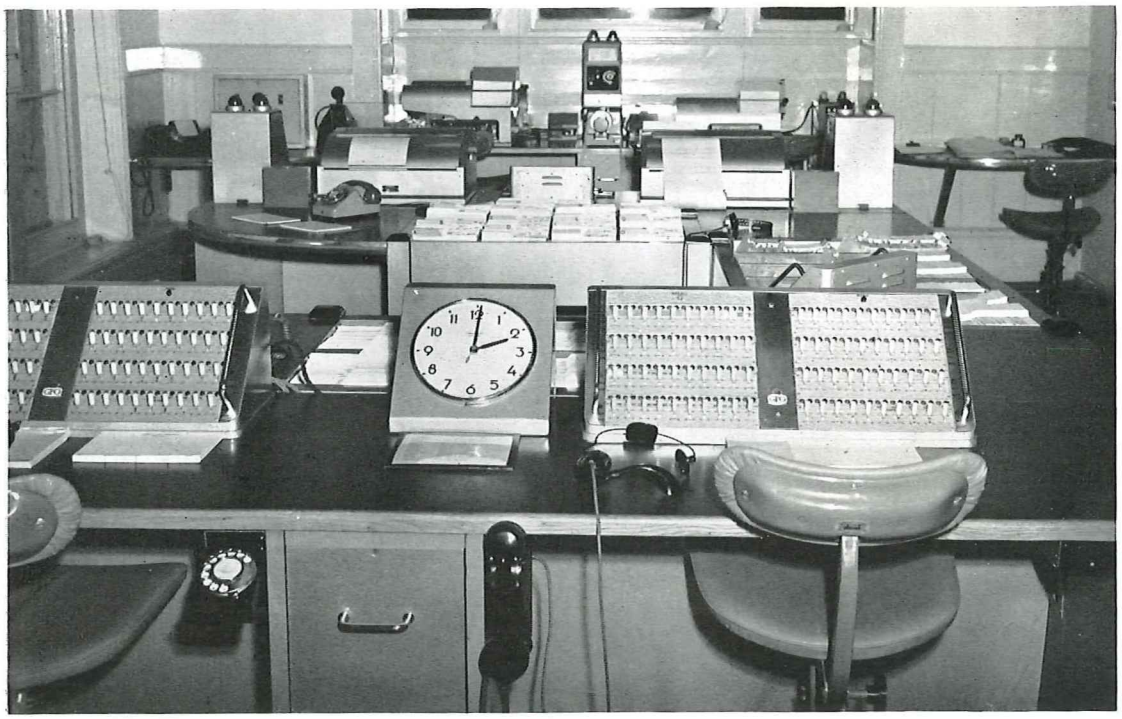
In the Brigade Headquarters Operations Room for the receipt of fire calls there is a specially designed suite of multipled 80-line key and lamp units. Signalling is mainly unidirectional but a method of recalling on an established call has been incorporated. Four types of circuits terminate on this equipment, these are:—

(1) OJM (outgoing junction multiple) circuits. Privately rented point to point circuits from each manual and auto-manual telephone exchange. They are the exchange operators' primary outlet for fire calls and the associated jack is situated on the outgoing junction multiple.

(2) Exchange lines. Operators' secondary outlet.

(3) Extension lines from the administrative PBX. Also tertiary outlet.

(4) Private circuits to hospitals, airports, factories. Circuits to adjacent fire authorities have two-way calling.



Surrey Fire Brigade, Reigate control room

A listening set consisting of a headgear receiver and a lamp indicator panel is provided for the Mobilizing Officer. The indicator panel is a parallel multiple of the 80-line key and lamp unit, but without keys or means of interception; this serves as a monitoring instrument.

Telegraph Component

Basically, the system is a miniature auto-manual telex network with unidirectional dialling. Each fire station is connected to the nearest of four automatic sub-exchanges (ASE). These are in Post Office buildings, that is, Fairlands, Reigate and Weybridge telephone exchanges, and in the Repeater Station in Guildford. The fourth is in Reigate Fire Brigade Headquarters. Each ASE is linked to Fire Headquarters control equipment by two junction circuits.

Brigade Operations Room telegraph equipment consists of a specially designed cordless type concentrator with key selection of junctions, four operating page teleprinters with "here is" facility, including one with reperforating facilities, dialling units and an automatic transmitter. A telex machine will probably be added later.

Fire stations are equipped with tape teleprinters and signalling units; dials are not provided. The receipt of two consecutive alarm bell signals operates station bells and station lights, and sirens and bells in firemen's homes. At part-time stations a code consisting of six "V"s is automatically transmitted back to control to indicate that the siren is "voicing".

Teleprinters at both Headquarters and fire stations have been provided with a typing character symbol representing a bell, printed when the secondary "j" key is depressed. One purpose of this is to record in print the correct operation of the "J" bell since it is not practicable to have separate audible signals on each teleprinter in the control room.

Further development includes junction circuits between Divisional Headquarters and the ASEs, thus providing an alternative control centre. In addition, arrangements are in hand for Divisional Headquarters to receive simultaneously messages

being sent to a station under its administrative control.

How the System Works

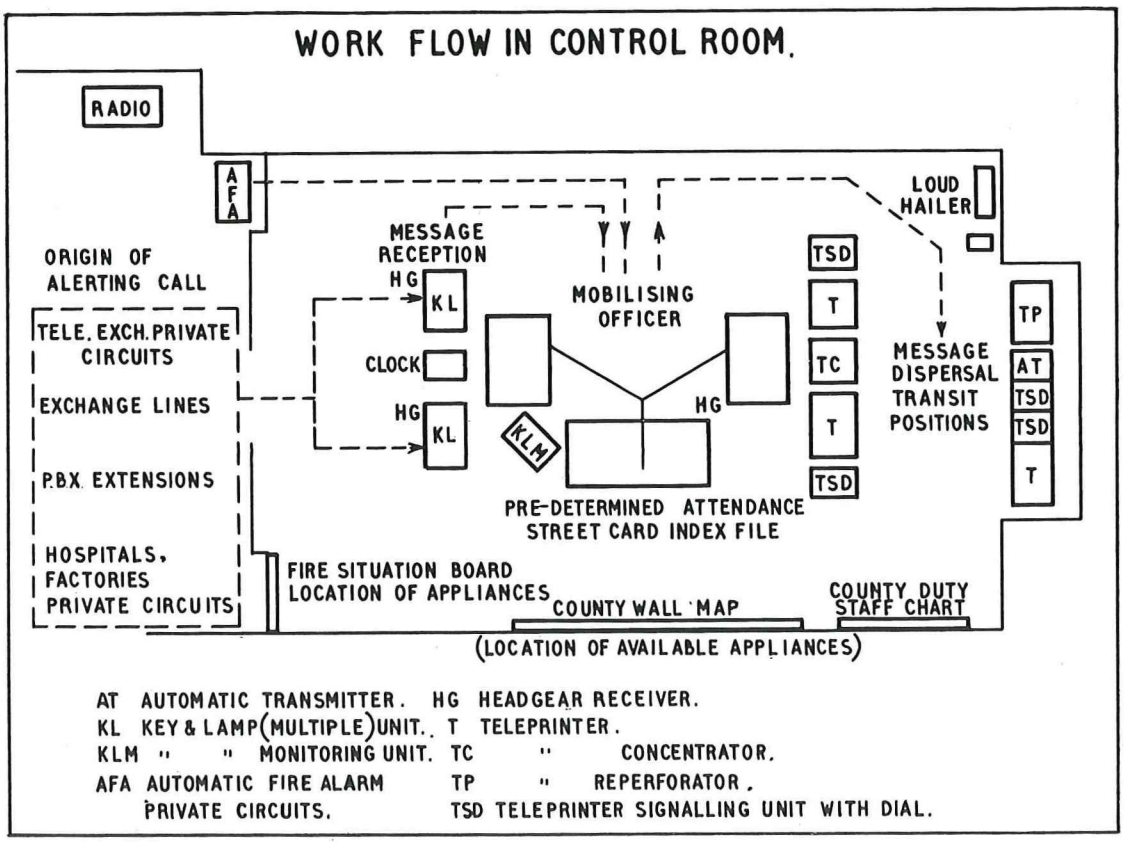
When a fire call is received from the telephone exchange a red opal lamp glows on each position of the key and lamp unit. One of these is constantly manned by a firewoman. Operating a key puts the caller in circuit and details of the fire incident are then written on a message pad. The Mobilizing Officer listens to the conversation on a monitor head set. He can ascertain the caller's approximate locality by looking at the indicator panel. The appropriate card is extracted from the street card index, the predetermined attendance is ascertained and, by reference to a wall size map, the up-to-the-minute situation is appraised. In the meantime, the Mobilizing Officer has been able to give the teleprinter operator the code name of the station to be warned and the basic details.

The teleprinter operator selects the appropriate ASE junction circuit by operating a key on the concentrator and calls the station concerned by dialling two digits. After the distant station answer-back code has been checked, the Headquarters teleprinter "J" bell key is depressed twice. This starts the distant station alarm bells or siren and at night-time switches on automatically certain electric lights. The operator then transmits the address of the incident, the appliances to be sent and the time of origin.

By this time, the operator at the key and lamp unit has checked back the address with the caller and endeavours to obtain other details such as nature of the fire and the telephone number from which the call was made. The message, having been time receipted, is passed to the teleprinter operator for checking and record purposes. The distant fire station has by now acknowledged receipt by merely depressing the "here is" key, and the appliances leave the station for the incident.

Finally, an operator in Brigade Headquarters control verifies the emergency telephone call with the exchange supervisor. One of the great advantages

Message being received, appliance ready to go



of the new system so far as the Brigade is concerned is that the warning to the station can proceed simultaneously with the receipt of the fire call.

Interim Report

The new scheme has made a revolutionary change in the entire fire communication system and involves a radical alteration in control and station apparatus. Surrey County Council has stated publicly that the new system has improved efficiency and enabled substantial economies. The Post Office, for its part, has been able to use auto-manual telex service equipment which had become spare under the current automatic conversion programme and for which there was no foreseeable future use.

From its inception the new system was subjected to a severe test because of the abnormal number of fires—sometimes as many as 200 in a single day. This high level continued almost unabated for the first three months owing to the unusually dry summer. Although the Operations Room staff at Brigade Headquarters had no practical experience of operating in such conditions the new system proved highly satisfactory, fast and reliable. The Brigade has confirmed that it provides a quicker means of dealing with emergency calls than its previous system.

An important factor of the new system is that it does away with something hitherto indispensable in the fire stations—the "Watchroom Attendant", with resultant economy. This has freed a number of men for fire fighting formerly employed on rota watchroom duties for 24 hours a day, and one of whom always had to remain behind to receive any further telephone calls that might be routed to the local station.

At part-time stations the first fireman to arrive no longer has to answer the telephone and take down in writing details of the message but instead can immediately prepare the appliance for departure.

The project could not have been planned and installed without the fullest consultation, and the utmost co-operation of the Surrey Fire Service, and the Post Office is grateful for their willing participation.

The design of the system and the estimation of costs was a joint effort in which Sales, Traffic, Telegraph and Engineering staff all played a part. Arrangements were made for the telephone exchange supervisors to visit Fire Headquarters to acquaint themselves with the new emergency procedure.

The system has aroused considerable interest and has been viewed by Fire Service officials from many parts of the United Kingdom. The fire brigades of East Suffolk, Hampshire, Kent and Lancashire have already opened preliminary negotiations with the Post Office.

Telecommunications Terminology

It is well known that the sector of human activity known as Telecommunications covers a wide field of techniques and phenomena, ranging from the digging of holes for telegraph poles to the scattering of electromagnetic waves in the troposphere. Nevertheless it may come as a surprise that as many as 10,000 terms could be assembled in a dictionary restricted in scope to Telecommunications.

Elsevier's Telecommunication Dictionary in six languages is a revised form of one compiled by Mr. A. Visser, head of the Dutch P.T.T. Documentation Services, and issued in 1955 by the Dutch P.T.T. for the use of its own staff. This earlier issue has proved to be very useful.

The new edition, prepared under Mr. Visser's supervision, has been rearranged so that the terms appear in alphabetical order of the English versions, and some 1,200 terms have been added. For each term the equivalents in French, Spanish, Italian, German and Dutch are given and for each of these languages there is a separate thumb-indexed section in which the terms are arranged in alphabetical order in that language with numerical references to the corresponding English term.

Thus in general it is necessary to make two entries into the dictionary, except when the starting language is English. This is to be preferred to the multi-column arrangement sometimes used in multi-lingual dictionaries and in the present book the material is so set out on the pages that it is very easily read, and rapid reference is facilitated.

The publisher's statement on the jacket asserts that the dictionary includes "all terms used in the telecommunications world", but although the book includes nearly 10,000 terms it is easy to compile a long list of omissions. Examples are Cathode Follower, Magnetic Drum, Ferrite, All-pass Network, Voice-frequency Receiver, Vestigial Sideband and Trigger. It is only fair to mention, however, that Elsevier already publishes other six-language dictionaries including *Television, Radar and Antennas*, *Electronics and Waveguides*, *Amplification Modulation Reception and Transmission* and *Automation, Electronic Computers and Control*. Many of the missing terms can be found in one or another of these dictionaries and to combine them all in one volume would lead to a book too bulky to be convenient.

Inevitably some terms require a few words of explanation to indicate, for example, the context in which they are used. The Dutch origin of this dictionary is reflected in the fact that such explanations are given in Dutch only. The dictionary was compiled originally from a collection of terms encountered by Mr. Visser in his work as a librarian and documentalist. A great deal of work has clearly been put into its preparation and the layout, printing and binding are exceptionally good. The book has been constructed to withstand hard wear. Such defects as have been noted are probably inevitable in a work of this kind and if the price seems high one might reflect that it corresponds to a rate of 66 terms (each in six languages) for a shilling, surely very good value for money.

Elsevier's Telecommunication Dictionary, 1960; Van Nostrand, London. 1011 pp. £7. 7s. 0d.

H. D. Bickley

The Postmaster General and the Indian Minister for Transport and Communications exchanged messages on the opening (March 5) of the Madras Telecommunication Centre which provides radio-telegraph service between the southern region of India, and London, and both telegraph and radio-telephone services with Singapore and Malaya.

* * *

Transmission of ultra high frequency radio waves to the moon and back are reported to have proved "conclusively" that at times of auroral display there is a marked increase in frequency of fading.

The experiment was made from the Geophysical Institute, Alaska. The waves were received back near Ontario and at Westford, Mass.

Televising the Grand National

THE GRAND NATIONAL WAS TELEVISED THIS YEAR for the first time—the BBC's greatest television operation since the State Opening of Parliament.

Sixteen cameras were used and each was connected to one of the BBC control points, of which there were four; the Master Control was in the old Telegraph Room of Tattersall's Stand and the other three were Mobile Control Rooms (MCR) as used regularly for television outside broadcasts. The very impressive Master Control was built up mainly from equipment taken from Mobile Control Rooms "derigged" for that purpose.

The Post Office function in respect of vision signals was to use convenient pairs in telephone-type cables for interconnecting the Control Rooms; most of the cables had been installed previously for sound broadcasting purposes and connected the stand area with no fewer than 60 points around the course and along the motor track, but three new points were necessary for the Grand National. Liverpool Telephone Manager's staff provided these new points by laying two 7-pair cables to Becher's Brook. Fig. 1 shows the vision circuits provided, the working circuits in full line and Post Office reserve circuits in broken line; arrowheads indicate the direction of transmission.

Vision signals from BBC equipment pass out through coaxial feeders; that is, they are unbalanced, and must be returned to the BBC in the same condition. Normal telephone cables are balanced, and introduce heavy loss at vision frequencies; the higher the frequency the greater the loss. Post Office equipment was therefore required to accept unbalanced signals, convert them to balanced signals, make good the loss introduced by the cable, and send out unbalanced signals as nearly as possible identical with those received.

Frank Leggett, Assistant Engineer in charge of the North West Regional television outside broadcast team had a special problem because of space limitations, in addition to his normal task of ensuring that the large amount of equipment was in first class condition. The Master Control Room was so congested that he was allowed an annex measuring only 12 feet by 5 feet, and at the MCR3 point our normal outside broadcast vehicle would not suffice for the amount of equipment necessary at

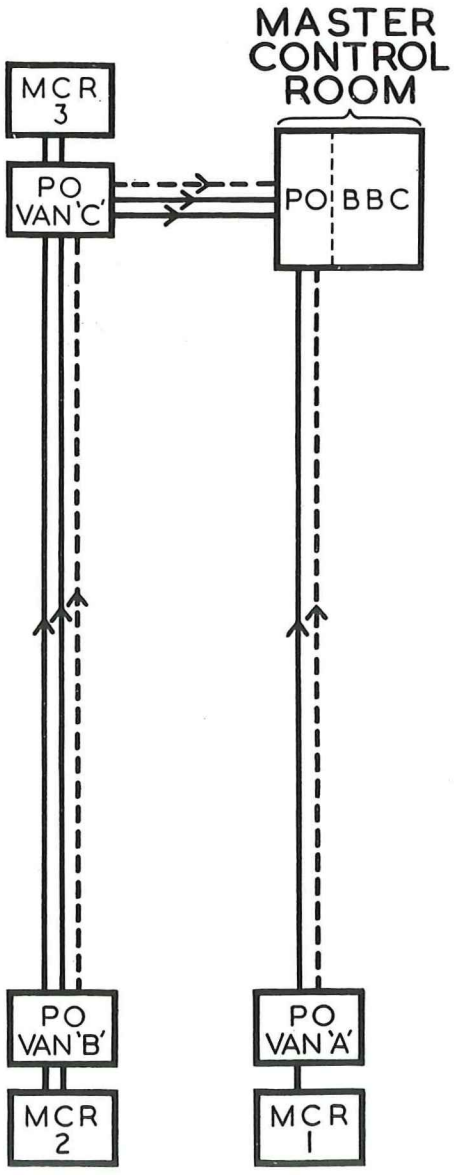


Fig. 1: Vision circuits

Mobile control room and Post Office vehicle at Becher's Brook

that point. The problem was solved by two means; a not very elegant but large-capacity stores vehicle was borrowed from Fleet Transport and the equipment for it, and for the Master Control point, was assembled on racks specially constructed from slotted angle.

Power Supplies

Common power supplies and earth points are desirable where BBC and Post Office equipment are associated and it is therefore usual for Post Office power and earth to be taken from the BBC. At Aintree, however, BBC power vans necessary at two mobile points were not able to supply the total current required in our vehicles. At these two points therefore our line equipment used power taken from the BBC power vans but the test gear was supplied from our transportable diesel-electric sets.

Three cameras were connected to MCR2, three (including the Roving Eye) to MCR3, one to MCR1, and nine to the Master Control directly. Production was planned in great detail so that the Producer sitting at his desk in the Master Control could at any instant connect a selected camera to the national television network via a BBC radio link. This radio link was a temporary one set up between the Master Control Room and the Post Office radio station at Windy Hill near Oldham, where injection equipment was used on our permanent radio link from Kirk-o-Shotts to Manchester.

The total signal path served by any camera "on the air" was indeed great, and to state it gives some idea of the temporary and permanent lines and equipment necessary for such an undertaking. For example camera No. 11 used MCR2, equipment in our vehicle B, cable to our vehicle C, equipment in our vehicle C, MCR3, more equipment in our Master Control, vehicle C, cable to our equipment in Master Control, temporary radio link to Windy Hill, permanent Post Office radio link to Manchester, permanent Post Office cable link to the BBC, London, and then back over permanent Post Office cable and radio links to all BBC switching centres and transmitting stations.

H. CHEETHAM.

The BBC published a brief description in the March 18 Radio Times, *and we are able to publish this outline of the engineering organization in which the Post Office played a part, by courtesy of the Corporation.*

Telecommunications Statistics

	Quarter ended 31 December 1959	Quarter ended 30 September 1959	Quarter ended 31 December 1958
Telegraph Service			
Inland telegrams (excluding Press and Railway) ...	3,080,000	3,651,000	3,117,000
Oversea telegrams:			
Originating U.K. messages	1,670,646	1,679,725	1,222,500
Terminating U.K. messages	1,637,824	1,616,692	1,245,109
Transit messages	1,542,529	1,397,408	1,406,144
Greetings telegrams	725,000	902,000	705,000
Telephone Service			
Inland			
Gross demand	115,948	109,860	99,977
Connexions supplied	106,558	100,010	95,693
Outstanding applications	132,691	137,683	146,339
Total working connexions	4,727,017	4,680,680	4,568,781
Shared service connexions	1,128,871	1,131,768	1,140,039
Total inland trunk calls	95,875,000	97,149,000	86,232,000
Cheap rate trunk calls	20,225,000	23,691,000	19,286,000
Oversea			
European: Outward	719,176	699,815	626,624
Inward	718,999	697,700	600,487
Transit	400	806	2,342
Extra-European: Outward	69,521	61,863	61,445
Inward	80,182	68,280	68,073
Transit	20,748	19,366	16,902
Telex Service			
Inland			
Total working lines	5,689	5,438	4,827
Calls from manual exchanges	614,000	698,000	632,000
Calls from automatic exchanges	287,000	220,000	169,000
Metered units from automatic exchanges ...	2,547,000	945,000	762,000
Oversea			
Originating (U.K. and Irish Republic) ...	635,020	568,352	505,436
Terminating (U.K. and Irish Republic) ...	605,937	550,091	491,664
Transit	7,948	7,291	6,049

"Zone Charging" in Australia

The Australian Post Office introduced "zone charging", similar to our group charging, on May 1. Exchanges are now grouped in zones based on community interest, calls within a zone and between adjacent zones being treated as untimed local calls. Most calls up to 25 miles, and many up to 35 miles, are now local calls.

Previously trunk call charges were divided into 22 separate mileage categories, based on distances; these categories have now been reduced to eight. On short distance trunk calls the chargeable distance is measured between the zone centres; on long distance trunks, zones are grouped to form districts, the distance between districts determining charges. This enables reduction of the number of areas for assessment of trunk charges for any exchange from more than 7,300 to 300 on a zone-zone or district-district basis.

Commonwealth Meeting

Technical and Traffic experts from all the larger Commonwealth countries, as well as several of the smaller, attended in London during May a conference sponsored by the Commonwealth Telecommunications Board. Two previous conferences of this sort took place in 1950 and 1955.

More than 30 papers were prepared for discussion by the United Kingdom, Australia, South Africa and New Zealand, on overseas telegraph mechanization, international telex and related engineering developments.

Modernizing Subscribers' Apparatus

D. S. Pullin

Mr. Pullin is the Principal in charge of the new Merchandising Division of the Post Office Inland Telecommunications Department, the establishment of which Mr. F. I. Ray announced in his talk, "Follow-up on the Ray Report", published in our Spring number.

"The Merchandising Duty", said Mr. Ray, "has a list of some three dozen projects" but, he added, "development of subscribers' apparatus is a lengthy business and it will be a matter of years before the start of the new projects and the full availability of supplies.

THE DEVELOPMENT OF THE FRIENDLY TELEPHONE Service has underlined the importance of creating a proper image of the Post Office in the public mind. The efforts being made to improve all aspects of the service call for similar efforts to improve the "goods" that the Post Office supplies to its customers—the telephone instruments, PBX switchboards and other items of subscribers' apparatus may well be regarded as Post Office "goods". Old fashioned apparatus, no matter how technically efficient, inevitably suffers by comparison with modern office and domestic appliances which now flood the market. One has only to visit an office equipped with modern furniture and office machinery to see how old fashioned the telephone switchboard looks in contrast.

In the past few years considerable thought and effort have been directed towards modernizing subscribers' apparatus. The first results appeared last year with the introduction of the new (700 type) telephone instrument. This is the forerunner of a number of new items that should become available during the course of this and the next two or three years. The purpose of this article is to outline some of the considerations that affect the development and introduction of new apparatus and to describe some of the new items to be introduced.

Priorities

With the considerable range of apparatus involved it is clearly impracticable to modernize all items at the same time. The Post Office staff engaged on this work is necessarily limited and, although the actual development of a new design can sometimes be "hived off" to outside manufacturers, the Post Office has in the first place to decide what facilities are to be provided and sometimes to devise the basic circuitry; then it has to examine in detail the various alternative designs suggested by the manufacturer before a final choice is made. To make the best use of the capacity available the prospective development projects have to be placed in a broad order of priority.

Here are some of the things that have to be considered; no attempt has been made to place them in order of relative importance:

(a) whether the new item must be available in time for some important change in the telephone system. An example is the subscriber's private meter for STD;

(b) whether the requirement results from the introduction of some other new apparatus. Examples are multi-button versions of the new 700 type telephone that will be required for certain extension installations;

(c) the scale of public demand for any new or improved facilities that the new apparatus can provide;

(d) whether improvement of the technical performance of the existing counterpart apparatus

will produce benefits in other directions. Thus the 700 type telephone was developed partly to facilitate economies in line plant;

(e) the stock and supply position of the item to be superseded;

(f) whether the apparatus forms an essential part of the basic telephone service (for example, a headset for a private branch exchange operator) or whether it is an ancillary item.

It is often found that when an existing item is to be modernized the facilities it offers are already adequate. But what is needed is improvement in technical performance, saving in maintenance requirements and modernization of the components and external appearance.

With novel apparatus there is, of course, no previous Post Office pattern around which to design it. Some pointers may, however, be obtained from the facilities offered by equipment used in other countries or supplied in this country by outside manufacturers as "approved attachments" or for use with privately owned internal telephone systems. Then, too, there is sometimes a useful fund of knowledge within the Post Office based on experience in dealing with customers' requests for non-standard facilities.

Market Research

The extent to which modern market research methods can be used to produce a better picture than at present of the kind of apparatus and facilities our customers want has yet to be fully explored. The idea of obtaining public reaction to alternative designs of a new item by door-to-door visits with sample models is a possibility but there are practical difficulties; for example, in making sufficient sample models. In addition, any research

Fig. 1: Prototype 4-button Telephone No. 710

of this kind must be arranged to ensure as far as possible that it does not stimulate demand for a new item long before it can be met and does not invite embarrassing questions about tariffs before full costing information is available.

Undoubtedly lessons can be learnt from a study of the telephone market research methods in the United States, although for various reasons the problem there is different in many respects. For example, the American telephone administration has its own manufacturing organization which can produce batches of sample models of alternative designs. Furthermore, the American public need for telephone service has already been met to a much greater extent than in this country and there is not therefore the same immediate pressure for a new device as soon as its development is announced.

External Appearance

There is clearly ample scope and need for modernizing the appearance of most of the existing items of subscribers' apparatus. The most significant steps that can be taken are:—

(a) to use new basic materials, such as plastic or fibre glass instead of wood;
(b) to modernize the shape;
(c) to reduce the size and weight by using smaller components and a more compact layout;
(d) to introduce a range of colours.

Some of this comes within the field of the industrial designer and the manufacturers developing new apparatus for the Post Office often employ industrial designers for this part of the work. To ensure a satisfactory design standard the Post Office usually arranges for new models to be shown to the Council of Industrial Design before final approval. The Council's advice is, of course, particularly valuable in such matters as choice of colour, where there is room for considerable differences of taste.

As colour is assuming increased importance in modern life there is a growing tendency to produce subscribers' apparatus in different colours. This trend is facilitated by using self-coloured plastics for cladding and external components. The selection of a range of colours for any particular item of apparatus must be a compromise between having a wide variety of colours to meet all possible demands and keeping the cost to a reasonable level. The choice and range of colours must depend to some extent on the type of accommodation in which the apparatus is most likely to be used (for example, the home or the office) and on the expected demand. As the telephone instrument itself is the most extensively used apparatus it seems unlikely that the range of six colours in which the new (700 type) telephone is available will be exceeded or even reached for other apparatus.

Fig. 2: Telephone No. 706 standing on a model of the 6-button plinth for Extension Plans Nos. 5, 5A, 7 and 7A

The table below showing the distribution by colours of the public demand for the new telephone to December 31 1959, may be of interest, but it must be remembered that our customers had not up to then seen many of the new telephones and the pattern of demand may well change appreciably in the future.

	Light Ivory	Two-tone Grey	Lacquer Red	Two-tone Green	Topaz Yellow	Concord Blue	Colour not Specified
Number ordered	21,093	4,007	3,164	1,716	962	679	1,954
Percentage of total orders	62.8	12.0	9.4	5.1	2.9	2.0	5.8

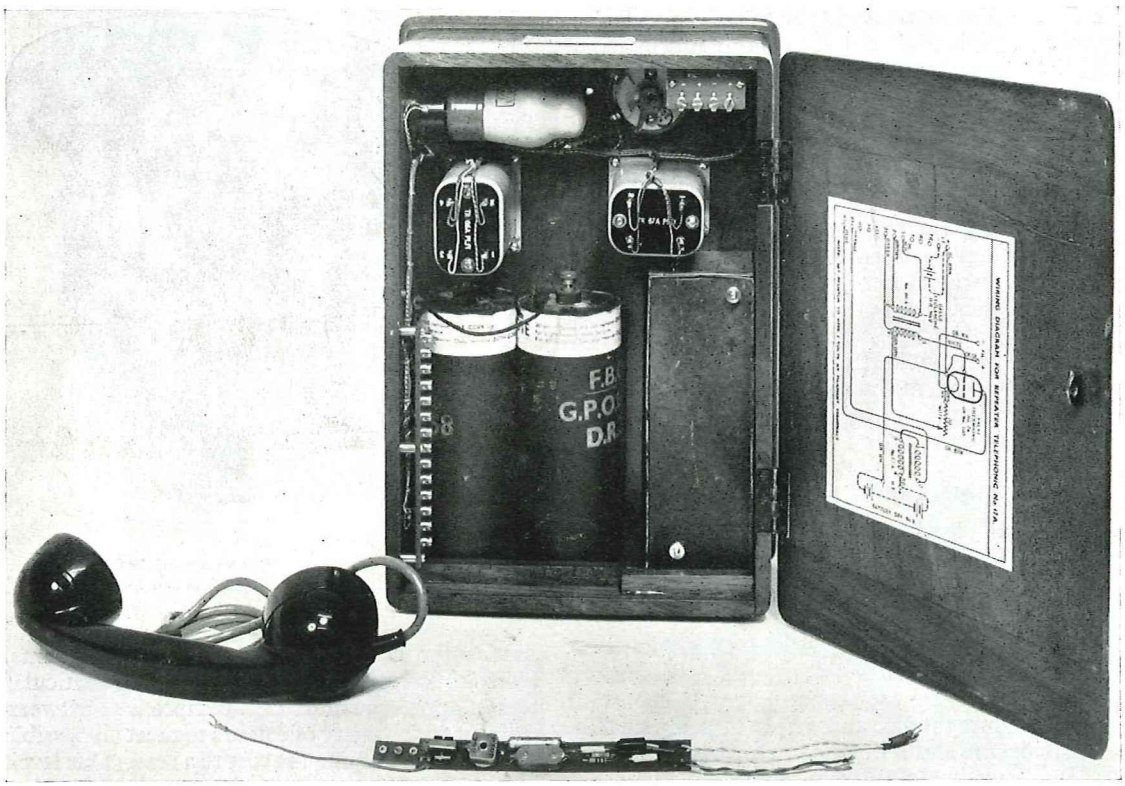


Fig. 3: 700 type telephone handset incorporating new transistor amplifier. The amplifier is shown separately for comparison with the present valve amplifier

The main problems in fixing tariffs for new apparatus arise when the new item is the modern counterpart of an existing standard item. The aim is to devise a tariff which, while covering the annual cost, is not markedly different from the tariff for the superseded apparatus yet at the same time does not encourage an embarrassing demand from subscribers wishing to have their existing equipment replaced. Against this background it is important when designing superseding apparatus to ensure that the costs are kept as far as possible within the bounds of the present tariff. If this is impracticable and the new apparatus costs much more it may be necessary to continue supplying the old type for subscribers unwilling to pay a higher tariff.

From the time the decision is taken to develop a new piece of apparatus to the receipt of first supplies some two to three years or more will elapse. Constant efforts are being made to reduce this period but the possibilities for doing so are limited. It is seldom worthwhile merely to re-house existing apparatus in a modern casing without reviewing the facilities and technical performance to see if improvements are desirable. In the present circumstances we have in particular to ensure that newly designed apparatus will function satisfactorily on local lines of 1,000 ohms resistance. These considerations involve study by several interests on the Sales, Operational and Engineering sides.

Then there is the actual design and development work, which may be undertaken partly by the Post Office and partly by a manufacturer; various alternative designs may be considered by the manufacturer, the Post Office and the Council of Industrial Design. Finally, once the design has been settled, detailed drawings have to be prepared and the manufacturers have to "tool up". This last operation alone rarely takes less than 12 months.

During 1959 the Post Office introduced the new (700 type) telephone instrument, the one-piece

lightweight headset for switchboard operators, clock and cyclometer type private meters, the pay-on-answer coin-box for subscribers in STD areas, and an answering machine to answer the telephone in the subscriber's absence. Many other items are in various stages of consideration and development and of these the following are the first expected to become available.

Extension Installations

The first version of the new telephone (Telephone No. 706) is suitable for about 90 per cent. of subscribers' installations but because it has only one press button it cannot be used on the more complicated extension installations. Two further items are therefore being developed; one is a 700 type instrument incorporating four press buttons, to be known as the Telephone No. 710 (see Fig. 1), and the other is a plinth with six press buttons on which the Telephone No. 706 will stand (see Fig. 2). These two units will meet all foreseeable requirements for extension installations requiring instruments with more than one press button. The six button plinth, which will match the handset of the two-tone grey telephone, will replace the present Bell Set No. 44 with its somewhat cumbersome lever switch for use at the main stations of extension Plans Nos. 5, 5A, 7 or 7A.

Wall Telephones

Although the wall telephone has so far had only a limited appeal in this country and has been used mainly in factories and garages there is scope for its wider use, particularly in the home. It is, for example, an excellent instrument for an extension in a kitchen where table space may be at a premium. Arrangements have been made to develop a telephone of the 700 type specially for fixing on a wall, but it will be some two or three years before this is available. In the meantime we intend to sample the demand for a modern wall telephone by modifying the table Telephone No. 706 for use as a wall instrument. In the modified version the dial and dial ring are turned through 180 degrees and the handset rest is altered so that the telephone can be mounted on the wall with the handset at the bottom.

Hearing Aid Telephone

A customer whose hearing is impaired, wishing to have a telephone giving amplified reception, is at present supplied with a battery operated valve amplifier housed in a large wooden box measuring 13″ high × 9½″ wide × 5″ deep. He will soon be able to have instead a telephone which, apart from having an unobtrusive volume control in the side of the handset earpiece, is to all outward appearance a standard telephone of the 700 type (see Fig. 3). This advance has been achieved by the design of a compact transistor amplifier which fits inside the stem of the standard telephone handset. The amplifier operates from the line current, so that batteries are unnecessary and maintenance costs will be saved. The tariff will be the same as that for the present valve amplifier.

Small Manual Switchboards

In the range of manual switchboards at present supplied by the Post Office, the cordless boards, with capacities of one exchange line and three extensions (1+3), two exchange lines and four extensions (2+4) and three exchange lines and nine extensions (3+9), are unduly bulky in appearance and are sadly in need of modernization. Design of a successor to the 2+4 has been completed and preparations are being made for its production. The new switchboard (a 2+6) will have a grey plastic case and although it will provide for two more extensions than its predecessor it will be considerably smaller (see Fig. 4). Much of the reduction in size has been obtained by a change of circuit design, which uses three wires plus an earth wire to each extension instrument instead of the present two wires. Lamp signalling will replace the present indicators and power will be obtained from a mains driven unit instead of a battery.

A similar design is proposed for a new 3+12 switchboard but this will have in addition a new facility for automatically "holding" exchange calls, thus obviating the need for the operator to throw a "hold" key. This board will also include space for the optional fitting of STD private meters. Production should start soon after that of the 2+6 board.

Loudspeaking Telephones

Several types of proprietary loudspeaking telephones have for some time been available in this country but they have been restricted to use on internal private telephone systems. The technical problems to be overcome in designing a loudspeaking telephone for use on calls over the public telephone network are much greater because of the wider range of line conditions which are met. Nevertheless, design of the circuitry for a Post Office loudspeaking telephone for this purpose has now been completed and a contract has been placed

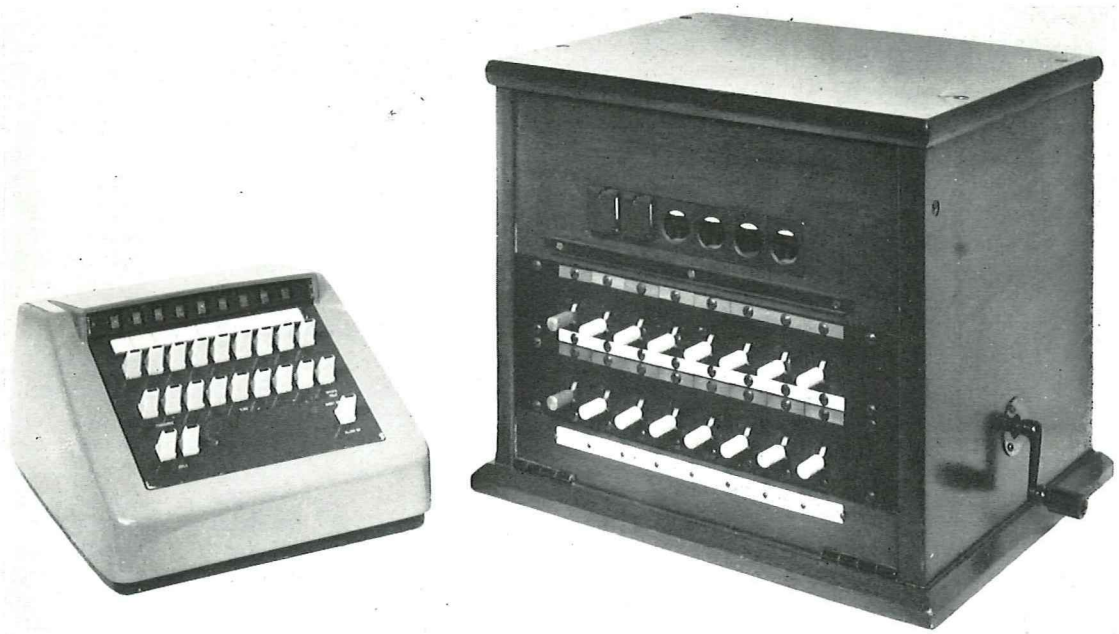


Fig. 4: The new 2+6 cordless switchboard compared with the present 2+4 switchboard

for full development of the apparatus to the production stage.

Considerable thought has been given to the arrangement of the loudspeaker, microphone, on-off switch and volume control. The main object has been to encourage the user to speak towards the microphone and within reasonable distance of it and to keep the microphone and loudspeaker well separated to avoid oscillation or "howling". In the arrangement finally selected there are two units: first, the normal telephone incorporating the loudspeaker in place of the dial, and, second, a plastic box (similar in shape to the clock type private meter) containing the microphone, dial, on-off switch and volume control key. The plastic box contains all the controls required for setting up or answering a call and the intention is that it should stand well forward on the user's table. As the telephone itself need not be touched unless the user wishes to conduct a conversation with the handset, it can stand further away than the microphone unit and at the other side of the table. The external design of the unit has not been completed but one suggested model is shown in Fig. 5.

A special application for the loudspeaking telephone is in laboratories, post mortem rooms and such places where to avoid risk of infection people have to use the telephone without touching it. The apparatus also has to be protected from damage when the room is decontaminated. Some installations of this kind have already been provided and arrangements are now being made to develop standard apparatus.

In the loudspeaking telephones described the most economical technique possible has been employed to enable them to be supplied at attractive tariffs. For certain applications, however, particularly where conversation is required between two loudspeaking telephones on the same installation or over short lines, a more elaborate system will be necessary. Arrangements are being made to obtain suitable apparatus but it will necessarily be more costly.

House Exchange Systems

The popularity of existing standard systems has been growing, although at the same time there has been some adverse comment on the bulky appearance of the apparatus. It is intended to use a modified form of the proposed four button telephone to provide a modern house exchange system with a capacity of one exchange line and four stations. A

new house exchange system with a capacity of two exchange lines and ten stations is also being developed.

FURTHER DEVELOPMENTS

Private Automatic Branch Exchanges

Visits to other countries, particularly Western Germany, have shown that there is scope for greater use of automatic switching apparatus to replace the manual switchboard systems in subscribers' premises. The Post Office already provides a range of PABXs for installations with capacities of four exchange lines and 15 extensions upwards, but the possibility of providing automatic exchanges for installations below this size is now being studied. One of the problems to be faced is that of cost and it seems very doubtful whether at this lower end of the scale the PABX will ever completely oust the small manual switchboard for the customer who requires his essential service at the minimum cost. On the other hand it is possible that a small PABX without elaborate facilities could be a competitor with the House Exchange System.

For larger installations with several hundred extensions the PABX with cordless operating positions is becoming increasingly popular. A Post Office standard cordless PABX is being developed for this purpose but it will be another two years or so before orders can be taken for it. To meet customers' demands in the meantime approval is being given for the use of a number of different designs prepared by the telephone equipment manufacturers.

Floor Pattern Manual Switchboards

Despite the trend towards automatization it is expected that there will be a continuing need for medium sized private manual branch exchanges particularly for specialized uses, in hotels for example. The main scope for modernizing the present switchboards probably lies in the introduction of lamp signalling and the use of new cladding materials to replace the present outmoded wooden cabinets.

Bedside Telephone

The interest aroused by the attractive appearance and other features of the new 700 type telephone suggests that there is probably a potential market for an even more advanced design of instrument. The possibilities are being examined of developing a smaller telephone suitable for a bedside table and incorporating such novel features as a night and dial light and a control to enable the user to adjust the volume of "ringing". Although the facilities in mind are primarily for a bedside telephone a luxury instrument of this kind might well become popular for use in other parts of the home.

Dialling Aids

Under STD conditions a subscriber may be required to dial up to 11 digits (including one for access from a PABX extension to the public exchange) to set up a call, and later, for international subscriber dialling, as many as 17. For the busy

Fig. 5: One of the suggested models of the proposed loud-speaking telephone

executive, his secretary and the PBX switchboard operator, there is clearly a need for some labour-saving device that will dial automatically. Such a device would not only reduce the physical effort of dialling but would also obviate the mental effort of remembering long numbers and would reduce the possibilities of dialling errors.

Various "repertory" diallers are already available in other countries. These differ considerably both in the method of operation from the user's point of view and in the technical arrangements for sending out the digit pulses. In principle, however, they all provide facilities whereby the user, by a simple operation—pressing a key, for example—can select from a store of pre-set numbers the number he requires and the device then sends out the necessary digits to set up the connexion. Several of the devices that have been examined are elaborate and expensive and efforts are being made to devise apparatus which will meet the needs of most customers at a reasonable cost.

While the range of items mentioned is by no means exhaustive, enough has perhaps been said to show that during the next few years there will be a transformation in the field of subscribers' apparatus. Modernization is inevitable and may be regarded as a worthwhile end in itself. At the same time the introduction of attractive designs and new facilities can play an important part in stimulating the use of the telephone system.

Training Experiments

In "Follow up on the Ray Report" (Spring *Journal*) Mr. Ray mentioned that the experiments in exchange supervision and operator training were to be extended. This has been done and the exchanges at which the experiment is now in operation are:—

Belfast
Birmingham (Tipton)
Burnley
Chester
Chesterfield
Edinburgh (Talisman)
Gloucester
Grimsby
Hull
Kirkcaldy
London Avenue
" Victoria
" Waterloo
Manchester (Edgeley)
" (Peterloo)
Merthyr Tydfil
Nottingham (Archer)
" (Castle)
Oxford
Plymouth
Preston
St. Helens
Sevenoaks
Southampton
Southend
Stoke-on-Trent (Vale)
" " (Trinity)
Swansea
Uxbridge

This means that there is now at least one experimental centre in each Directorate or Region.

* * *

Test for recruits ?—The "Crowther Committee" on Education (Central Advisory Council for Education, England: Report, Vol. 1, 15 to 18) have coined a new word, "numeracy" to "represent the mirror image of literacy".

"Just as by 'literacy' . . . we mean much more than its dictionary sense of the ability to read and write, so by 'numeracy' we mean more than mere ability to manipulate the rule of three . . . When we say that a historian or linguist is 'innumerate' we mean that he cannot even begin to understand what scientists and mathematicians are talking about . . . It is perhaps possible to distinguish two aspects of numeracy that should concern the Sixth Former. On the one hand is an understanding of the scientific approach to the study of phenomena —observation, hypothesis, experiment, verification. On the other hand, there is the need in the modern world to think quantitatively, to realize how far our problems are problems of degree even when they appear as problems of kind. Statistical ignorance and statistical fallacies are quite as widespread and quite as dangerous as the logical fallacies which come under the heading of illiteracy.

"The man who is innumerate is cut off from understanding some of the relatively new ways in which the human mind is now most busily at work. Numeracy has come to be an indispensable tool to the understanding and mastery of all phenomena".

Professor of Communication.—The country's first research chair in communication has been founded, by Granada Television, at London University. Dr. Donald McKay, who has been appointed, will have a team of two medical scientists, one or two psychologists, three or four physicists and electronics engineers, and eventually some sociologists. Their work will deal chiefly with the way the human brain deals with information it receives from eyes and ears. One project Dr. McKay has in mind is to discover whether the brain can translate a system of electronic sounds into words or letters.

Sir Gordon Radley Retires

Sir Gordon Radley, K.C.B., C.B.E., Ph.D. (Eng.), M.I.E.E., Director of the Post Office since 1955, retires on May 31. He is succeeded by Sir Ronald German, C.M.G., who has been a Deputy Director General since April 1959. Mr. W. A. Wolverson, Director of the Radio Services Department, succeeds Sir Ronald German.

Sir Gordon speaking at the British Electrical Conference, Brussels Exhibition, 1958

An Appreciation

With the retirement of Sir Gordon Radley the Post Office loses a Director General who, especially during his five years in that post, has impressed the stamp of his personality on the Department during a period of unprecedented development.

But Sir Gordon has throughout his 40 years' service proved himself a leader and his professional engineering knowledge has served him well in dealing with the technical problems of automation which are now so much to the fore.

Starting in 1920, after training at Faraday House Electrical Engineering College, in the Research Branch of the Engineering Department, he soon became prominent in the field work on interference done jointly by the Post Office and what is now the Central Electricity Authority when the first grid lines were built. His thesis on this subject earned him the degree of Ph.D. in Engineering at London University.

Dr. Radley became a Staff Engineer by 1939. In 1944 he was appointed Controller of Research and during his five years in charge of Dollis Hill was largely responsible for the hearing aid adopted in 1948 for the National Health Service.

During that period the Research Station designed the first submarine telephone cable repeaters. As Deputy Engineer-in-Chief from 1949, and Engineer-in-Chief from 1951 to 1954 Sir Gordon had the final responsibility on the British side for designing the first transatlantic telephone cable.

His outstanding abilities as an administrator as well as an engineer were recognized by his appointment as Director General in 1955, after a year as a Deputy Director General. As Director General he has shown himself to be as shrewd and enterprising in developing the postal services, and the many other aspects of Post Office services. He has been a driving force behind postal mechanization.

His services to telecommunications have been widely recognized beyond the Post Office; in 1956-57 he was President of the Institution of Electrical Engineers and in 1958 was presented with the Institution's Faraday Medal.

Sir Gordon has succeeded in his high office not only by his outstanding ability and tireless energy, but also by his personality and charm. His modest, even self-effacing manner cannot conceal the strength of his intellect or his force of character. His sincerity is patent. He is considerate of others, of their feelings and of their opinions. He inspires both respect and esteem in all who know him.

For a short period in 1952-53 Sir Gordon was a valued member of the *Journal's* Editorial Board.

The new Director General and Deputy Director General—see overleaf.

Sir Ronald German, C.M.G.

Sir Ronald German brings wide experience to his new post as Director General. Joining the Post Office in 1925 he dealt with posts, telegraphs and telephones in the field and spent some year's at administrative Headquarters before becoming, for three years, Assistant Director of Posts and Telegraphs in Khartoum.

From 1950 he was for nine years Postmaster General in East Africa, being responsible for all three services; he was knighted on retiring from that post. In February 1953 he wrote for the *Journal* on "Telecommunications in East Africa". He returned to the Post Office last year as Deputy Director General.

Sir Ronald has been characterized by those who know him well as being friendly, approachable, essentially modest, scrupulously fair, outspokenly frank, straight-forward in his dealings with everyone, and an administrator who gets things done.

Mr. W. A. Wolverson, C.B.

Mr. Wolverson, the new Deputy Director General, joined the Post Office in 1928 as Assistant Traffic Superintendent at St. Albans. Coming to Headquarters as an Assistant Principal 25 years ago he worked on posts and personnel and, in 1949, attended the Imperial Defence College, becoming Regional Director in the North West in 1950.

He was first Commandant of the Management Training Centre from 1951-1952, and then became first Director of the External Telecommunications Executive. He was one of the British team who negotiated the first transatlantic telephone cable and was on H.M.T.S. *Monarch* when she laid the first section off Newfoundland.

Since 1955 he has been Director of Radio Services (see photograph on page 121).

OUR CONTRIBUTORS

G. O. EVANS (joint author, "Radio Forecasting") contributed "Long-Distance Radiocommunication and the International Geophysical Year" to the Autumn 1957 *Journal* and his career is outlined in that issue.

E. N. JACK (joint author, "Teleprinters for Fire Brigades") entered the Post Office as a Boy Messenger in 1927 and was appointed Sorting Clerk and Telegraphist in 1931. He was an overseer instructor at the London Counter and Writing School before becoming a Sales Representative in South West Area, London Telecommunications Region, where he has since spent most of his time on Special Services work. From 1939-1941 he was a teleprinter instructor, as well as the battalion Fire Fighting Instructor, with the Royal Signals.

A. H. JOHNSTONE (joint author, "Teleprinters for Fire Brigades") is Chief Fire Officer, Surrey Fire Brigade. He joined the Fire Service, in Newcastle, in 1921 and became Chief Officer, Surrey, in 1948. He is a member of the Institution of Fire Engineers' Central Examination Committee; past-President, Institution of Fire Engineers and member of executive council; past-President, Chief Fire Officers Association and hon. member of corresponding associations in several other countries. Since 1926 he has been a member of various Home Office committees and working parties concerned with planning, organizing and developing the British Fire Service for normal and emergency purposes. He holds the King's Medal.

J. K. S. JOWETT (joint author, "Radio Forecasting") is an Assistant Staff Engineer in the Engineering Department Overseas Radio Planning and Provision Branch. After a period in Colchester and Cambridge Telephone Area in 1935, he joined the then Radio branch of the Engineer-in-Chief's Office in 1936. Since then he has been concerned particularly with radio link developments in the VHF and SHF bands and the development of national radio and television broadcasting services. In more recent years he has been concerned with questions of radio propagation and frequency planning and was a delegate to the Administrative Radio Conference at Geneva last year.

D. S. PULLIN ("Modernizing Subscribers' Apparatus") is Principal in charge of the recently formed Merchandising Division in the Subscribers' Services Branch of the Inland Telecommunications Department. He joined the Post Office in 1935 as an Assistant Traffic Superintendent and was posted to the Headquarters Traffic Section in 1938. During the war he served with Royal Signals in Europe, India and Singapore. He returned to I.T.D. in 1946 and became a Principal in 1951

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in Personnel Department. He re-joined I.T.D. in 1957 after a six months' course at the Joint Services Staff College.

C. W. C. RICHARDS ("Training Staff in Pakistan") is a Senior Executive Engineer on secondment to Pakistan as acting Assistant Staff Engineer. He entered the Post Office as a Probationary Inspector in 1935 and has spent most of his time on general telephone area work. He joined the Training Branch as Assistant Engineer (old style) during the post-war formative years when the Central Training School, Stone, was being planned and Regional schools were being developed, and later started the first engineering training centre in Wales and Border Counties. He visited Pakistan in 1951 to make a survey and prepare a training scheme for the Posts and Telegraphs Department, and he returned there in 1953 to put the scheme into effect. A keen radio amateur, he has maintained unofficial contact with Post Office Headquarters through A. O. Milne, G2M1 (see Spring 1958 *Journal*); as AP2CR he was the first radio amateur in Asia to operate on single-sideband.

C. A. RICHARDSON ("Telephone Communications on M.1") has been Assistant Controller of Sales in the Subscribers' Services Branch of Inland Telecommunications Department since 1951. He was appointed Probationary Inspector in the Engineering Department in 1935 after serving as a skilled workman in telephone exchanges and repeater stations in London. From 1935 to 1938 he was engaged on local line planning in the London Telecommunications Region and from 1938 to 1940 was an Inspector in Engineering Department Headquarters engaged on planning and provision of communications for the Service departments. He became an Assistant Traffic Superintendent in London Telecommunications Region in 1941 and until 1947 was engaged on exchange service and equipment work. Since appointment as a Sales Investigation Officer in 1947 he has been concerned with all aspects of Sales work in Post Office Headquarters. He is at present in charge of Sales development forecasting, Telecommunications Advisory Service and Market Research on subscribers' apparatus facilities.

W. J. E. TOBIN ("Keysending from Subscribers' Telephones") entered the Post Office in 1931 as a Probationary Assistant Engineer and after service on the Technical Section of the South Lancs. District and the London Engineering District, was promoted in 1939 to Area Engineer in the West Area of London Telecommunications Region with responsibility for the provision of subscribers and telephone exchange equipment. In 1947 was promoted to Assistant Staff Engineer in Telephone Branch and for two years was responsible for maintenance standards and procedures, and for seven years for the design and development of signalling systems, early studies of S.T.D. working and for C.C.I.F. matters relating to Signalling and Switching. In 1956 he was promoted to Staff Engineer of Telephone Branch and when this branch was divided into two in 1958 became Staff Engineer of the Telephone Exchange Systems Development Branch.

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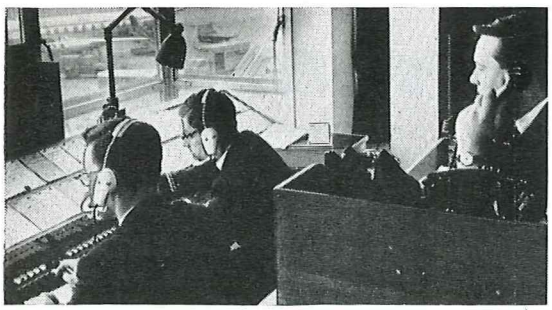
*Write for Brochure D/*104

STC Lightweight Head Receiver in use at Broadcasting House. These instruments have been adopted by the B.B.C. for use in their London and provincial studios.



At London Airport, B.E.A. Apron Control have recently reorganised their communication facilities to cater for their 400 air movements a day peak load. The controllers use STC Lightweight transmitter/receiver headsets to assist them with strain-free operation.

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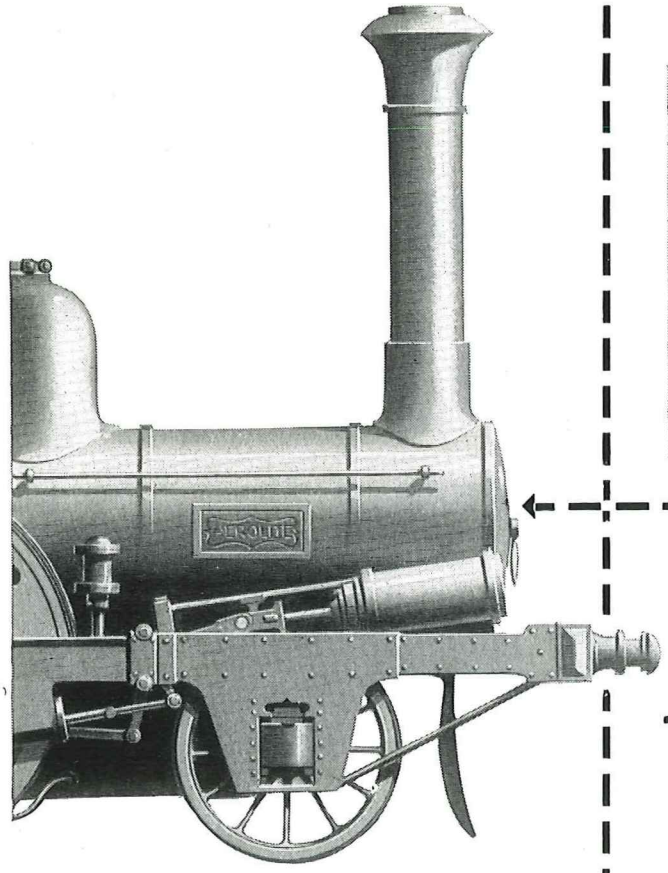

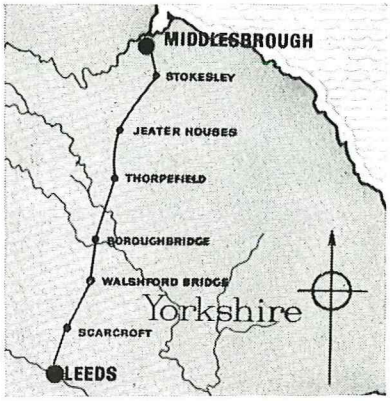

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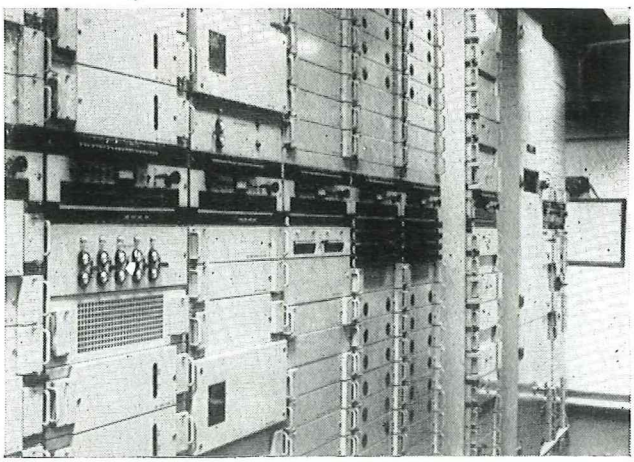

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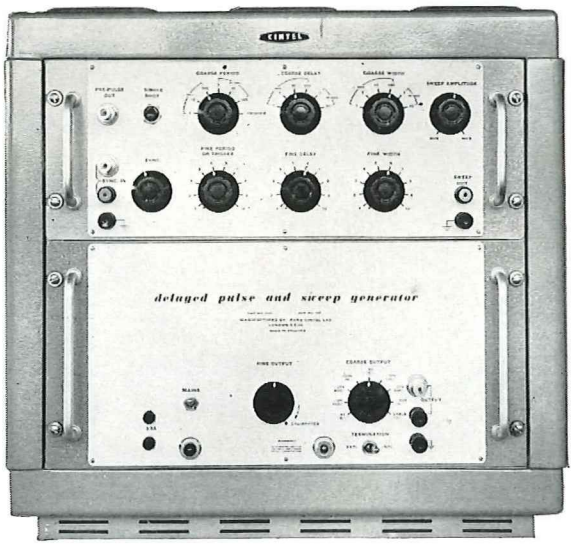

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Polarity: Positive or negative going.

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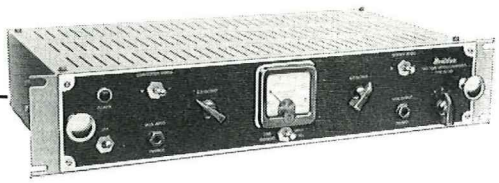

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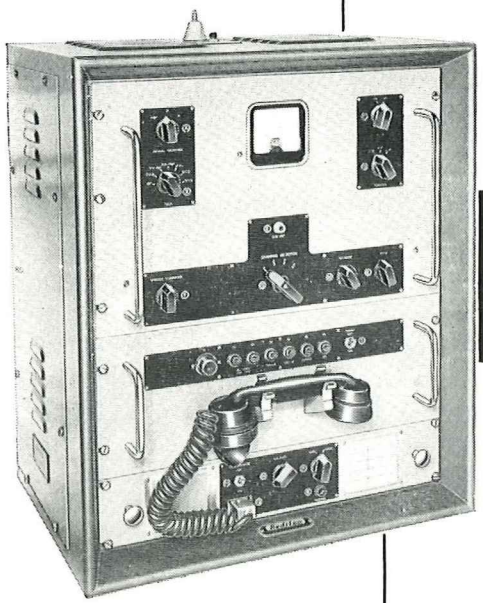

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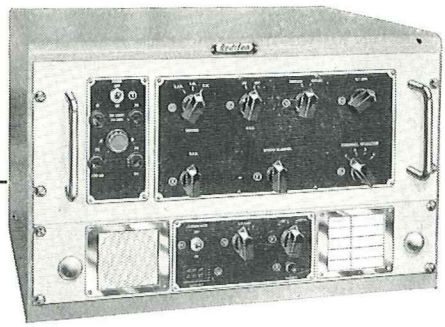

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